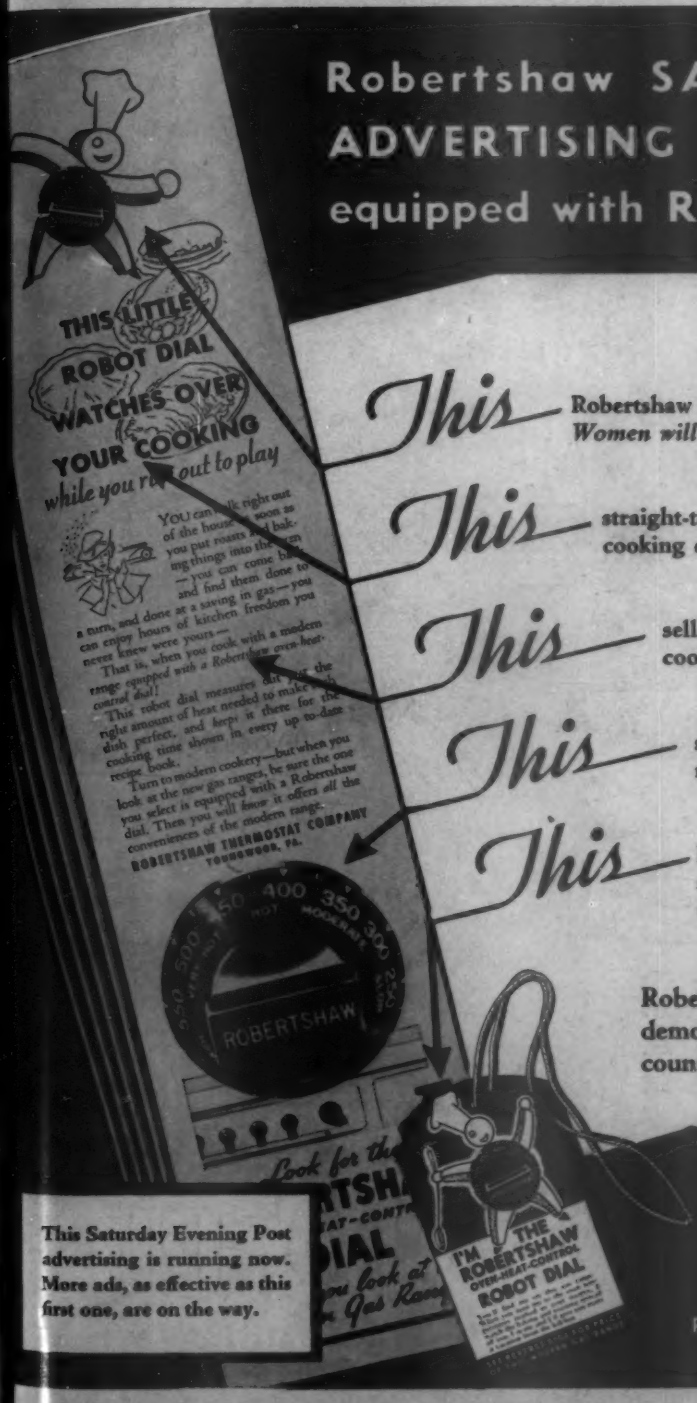
ol. 143, No. 4 October, 1935 Price 25c

AMERICAN GAS JOURNAL

Robertshaw SATURDAY EVENING POST ADVERTISING is selling the gas ranges equipped with ROBERTSHAW OVEN-HEAT-CONTROL


THIS LITTLE ROBOT DIAL WATCHES OVER YOUR COOKING
while you run out to play
ROBERTSHAW THERMOSTAT COMPANY
Youngwood, Pa.
ROBERTSHAW
I'M THE ROBERTSHAW OVEN-HEAT-CONTROL ROBOT DIAL

Here's why

This — Robertshaw Robot figure brings to life the Robertshaw oven-heat-control dial. *Women will never forget it!*

This — straight-to-the-point heading tells why Robertshaw oven-heat-control makes cooking easier. *Women will give it keen attention!*

This — sells the joys of the modern gas range—creates discontent with old-stove cooking. *Women will read it word for word!*

This — shows millions of prospects what the dial looks like when it's on your range. *Women will know where to find it!*

This — Robot tag carries the Robertshaw selling story right up to the point of sale. Hang it on all Robertshaw-equipped ranges displayed and identify them to women who want to buy. *Supplied free upon request.*

Robertshaw sustained advertising plus continuous cooking school demonstrations (more than 300 scheduled this year throughout the country) combine to make Robertshaw-equipped ranges easy to sell.

This Saturday Evening Post advertising is running now. More ads, as effective as this first one, are on the way.

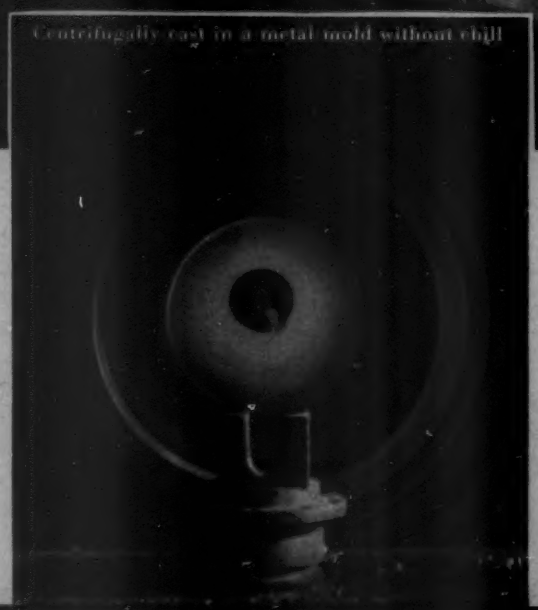
ROBERTSHAW
OVEN-HEAT-CONTROL
ROBERTSHAW THERMOSTAT COMPANY, Youngwood, Pa.

Library of Congress OCT 16 1935 Smithsonian Deposit

IMPACT RESISTANCE DOUBLED!

Unloading 5500 feet of 16" Super-de Lavaud Pipe at Water Department stockyard for installation at Washington, D. C.

THE full span of a cast iron water main's useful life is yet to be measured: witness the fact that the first recorded installation of cast iron water pipe is still in use after nearly three centuries of service. Certain it is that Super-de Lavaud centrifugally-cast pipe with its notably improved metal structure will more than live up to cast iron's unique reputation for long life. This is a *stronger, tougher, more ductile* cast iron pipe, made so by a patented and proved process in which gray iron is centrifugally-cast in a metal mold *without chill.* Impact resistance is *doubled* without lowering tensile or bursting strength. Send for descriptive brochure.



Centrifugally cast in a metal mold without chill

U.S. SUPER-de LAVAUD PIPE

CAST WITHOUT CHILL IN A METAL MOLD

UNITED STATES PIPE AND FOUNDRY CO., General Office: BURLINGTON, N. J.

Foundries and Sales Offices throughout the United States

AMERICAN GAS JOURNAL

Established 1859

OCTOBER 1935

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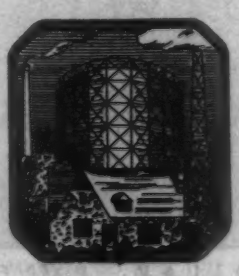

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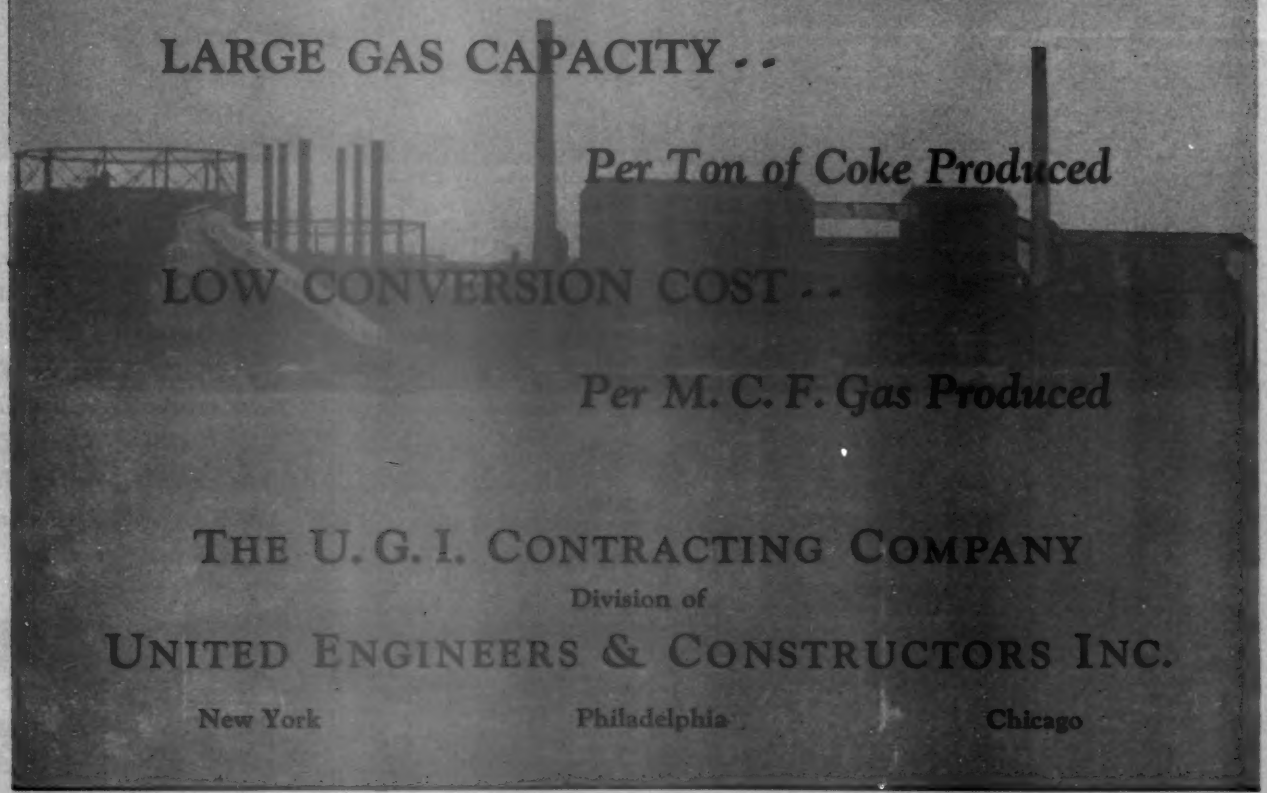
UGI

COST REDUCING

PROCESSES and APPARATUS

U. G. I. VERTICAL OVENS



LARGE GAS CAPACITY . .

Per Ton of Coke Produced

LOW CONVERSION COST . .

Per M. C. F. Gas Produced

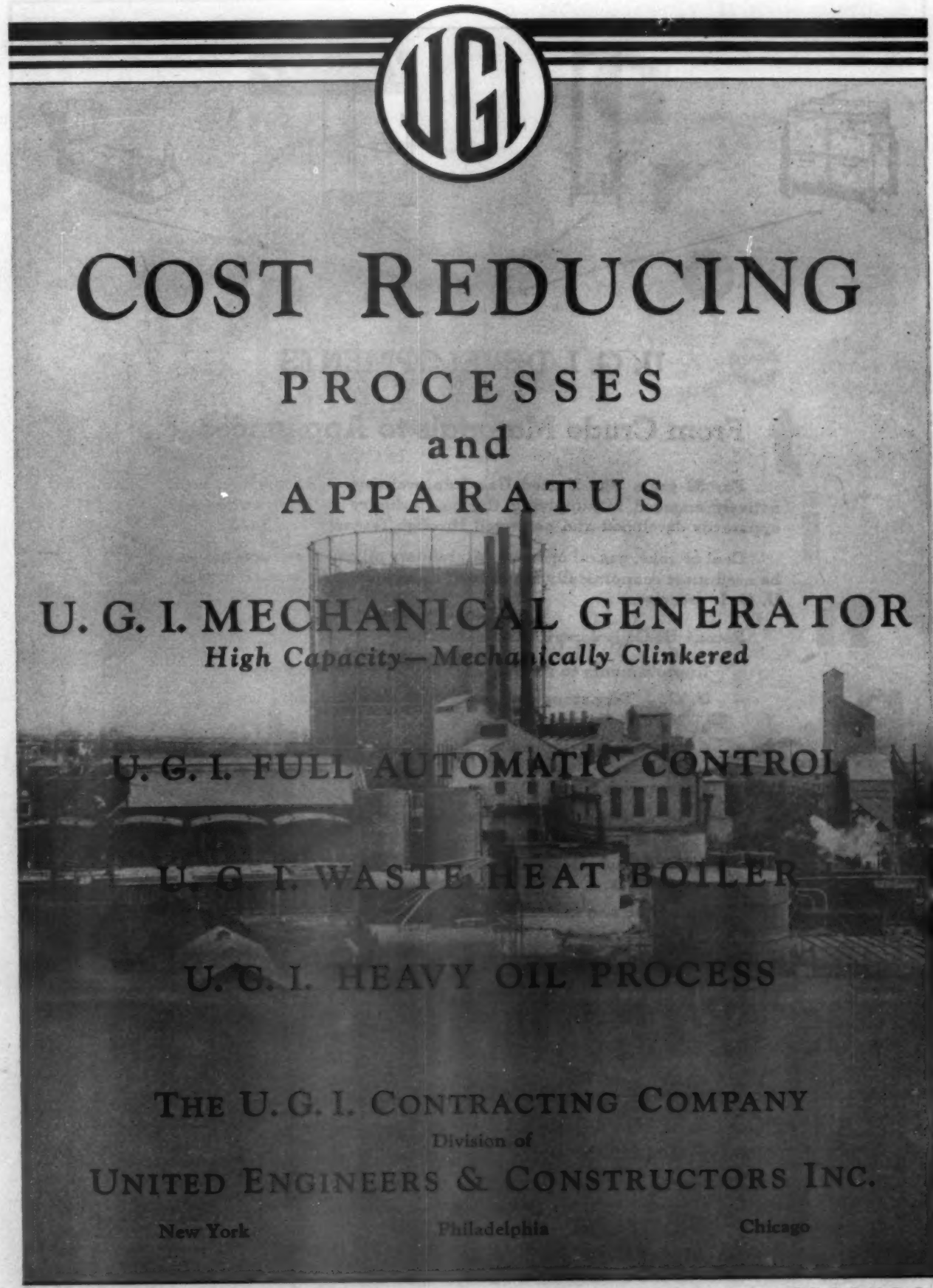
THE U. G. I. CONTRACTING COMPANY

Division of

UNITED ENGINEERS & CONSTRUCTORS INC.

New York Philadelphia Chicago

MAXIMUM RETURN TO CLIENTS PER DOLLAR EXPENDED



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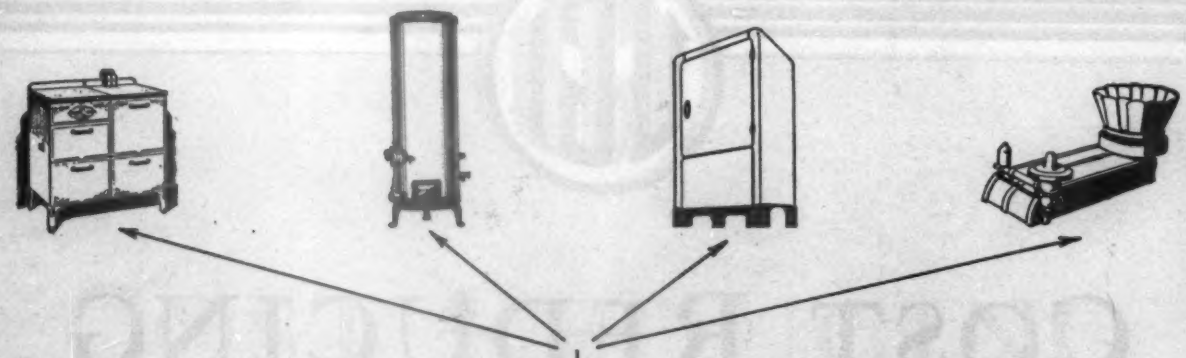


U. G. I. DEVELOPMENTS

From Crude Materials to Appliances

For 53 years The United Gas Improvement Company has been actively engaged in supplying the gas industry with processes and apparatus developed and perfected through research and tests.

Coal or coke, gas oil or heavy oil, refinery oil gas or natural gas can be used most economically for present day requirements with modern U. G. I. processes.

Recent U. G. I. contributions include—

Improvements to mechanical joints for cast iron pipe.

U. G. I. Servistops for preventing unauthorized use of gas.

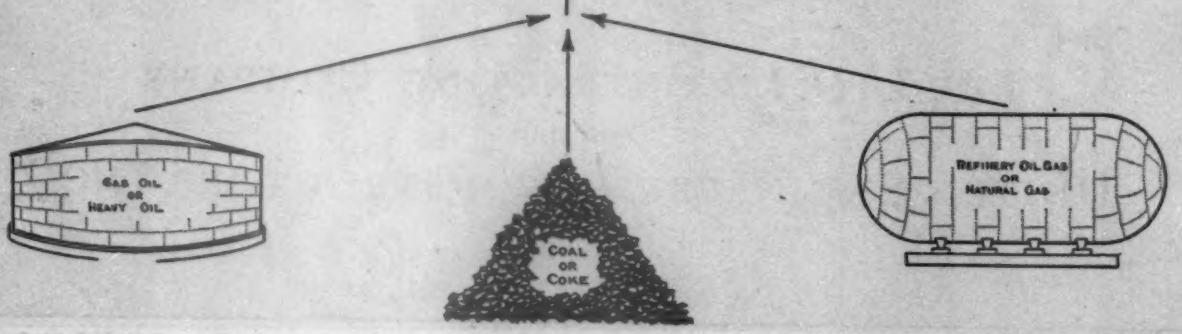
A new method for sealing old bell and spigot joints that are leaking due to the distribution of unsaturated gas.

U. G. I. dirt and gum filters that assure a clean gas at the appliance controls.

U. G. I. non-stop pilot controls that prevent pilot outages.

Recording and indicating instruments for determining oxides of nitrogen in the gas.

THE UNITED GAS IMPROVEMENT COMPANY



STACEY
SINCE 1851

Greetings

to members of the A+G+A CONVENTION

THE STACEY MANUFACTURING CO.

ENGINEERS • FABRICATORS • CONSTRUCTORS

A. A. RANSHAW, *President and General Mgr.*
W. W. BIRCH, *Vice-President*
EDW. J. BAECHLE, *Secretary and Treasurer*
IRWIN RAWSON, *Vice-President Charge of Sales*
FRANK O. PANDORF, *Vice-President Charge of Engr.*

CINCINNATI, OHIO
New York Office—19 West 34th Street

An independent organization not affiliated with any other builders of gas holders

PRICE
is only relative

CROZER · RODA · Admiral Coal · STONEGA · DENDRON · CRITERION COAL

THE value of a coal is measured entirely by the value of its resultant products and the cost of conversion. Increased values in gas, coke, and other by-products have, many times, more than justified a higher price for the coal from which they were produced.

The consistent high quality of GENERAL coals used in gas manufacture is due to careful standards of selection and preparation. We do not claim the lowest f.o.b. mine price per ton of coal, altho our locations in both the southern and northern fields permit us to select for any plant the coal most advantageously situated with regard to transportation cost. We do claim that the value of the resultant products from GENERAL coals make their use an economy based on actual operating results.

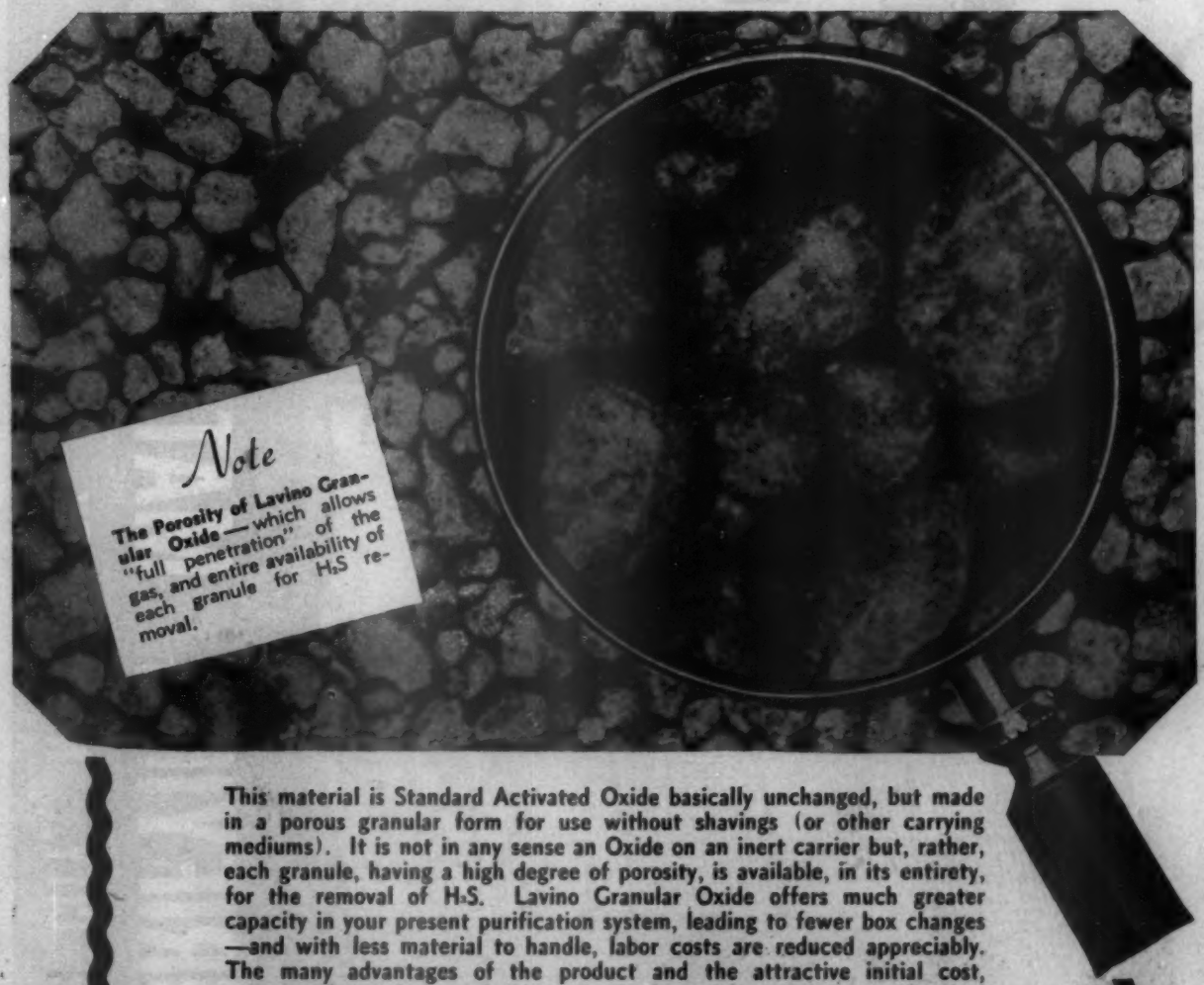
GENERAL COAL COMPANY
PHILADELPHIA, PA.

BOSTON · NEW YORK · CHARLOTTE, N. C. · PITTSBURGH · DETROIT · BUFFALO · IRWIN, PA. · CINCINNATI · RICHMOND

GENERAL COAL

LAVINO GRANULAR OXIDE

—increases Dry Box Capacity— and gives far more Purification


Note
The Porosity of Lavino Granular Oxide — which allows "full penetration" of the gas, and entire availability of each granule for H_2S removal.

This material is Standard Activated Oxide basically unchanged, but made in a porous granular form for use without shavings (or other carrying mediums). It is not in any sense an Oxide on an inert carrier but, rather, each granule, having a high degree of porosity, is available, in its entirety, for the removal of H_2S. Lavino Granular Oxide offers much greater capacity in your present purification system, leading to fewer box changes —and with less material to handle, labor costs are reduced appreciably. The many advantages of the product and the attractive initial cost, warrant thorough investigation of all those interested in purification. Write for full details or have one of our Specialists call—without obligation.

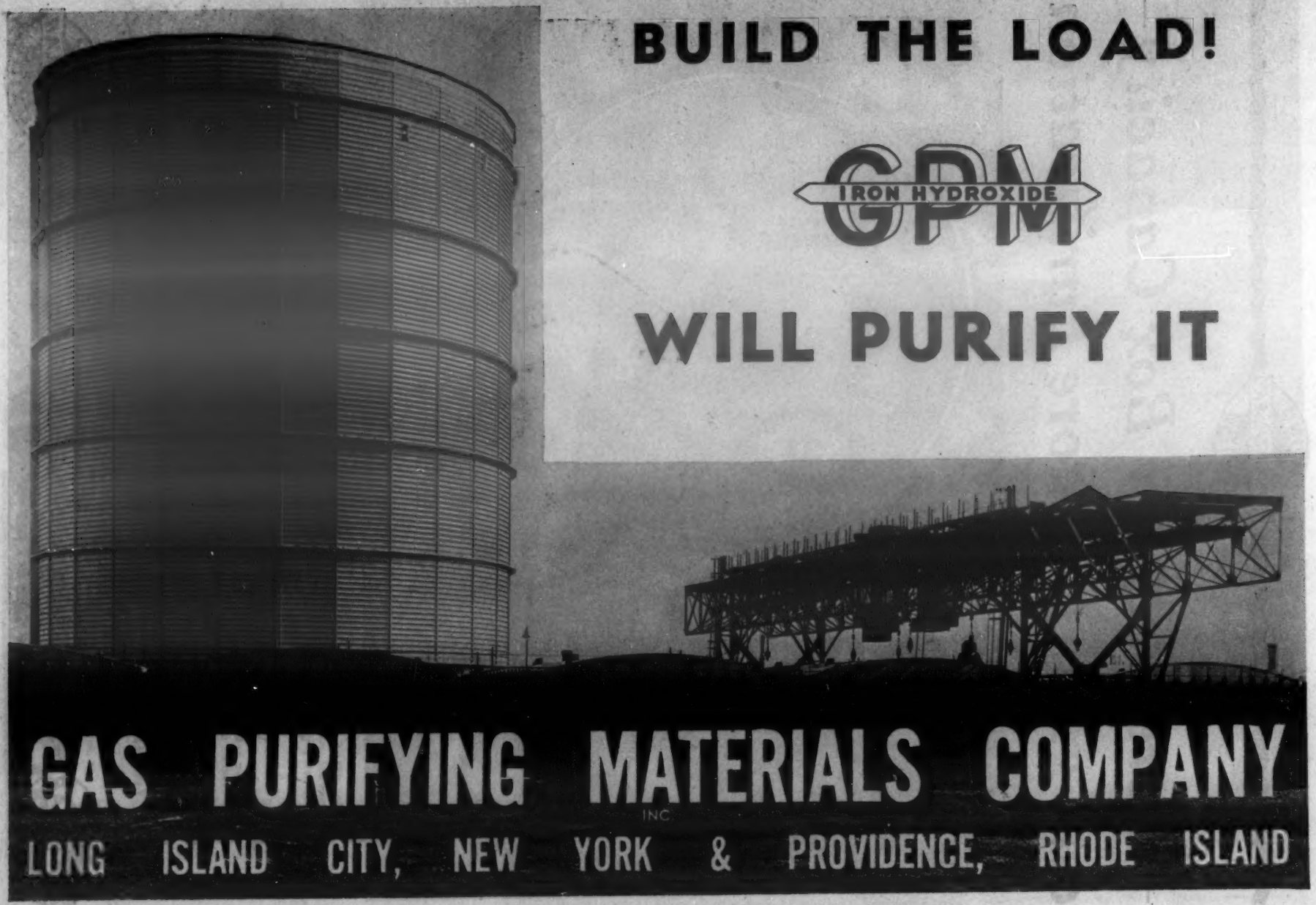
We also supply Lavino Activated Oxide for mixing with shavings or other carrying mediums—ready mixed—known as *Lavino Activated Sponge.*

E. J. LAVINO and COMPANY

1528 Walnut St., Phila., Pa.

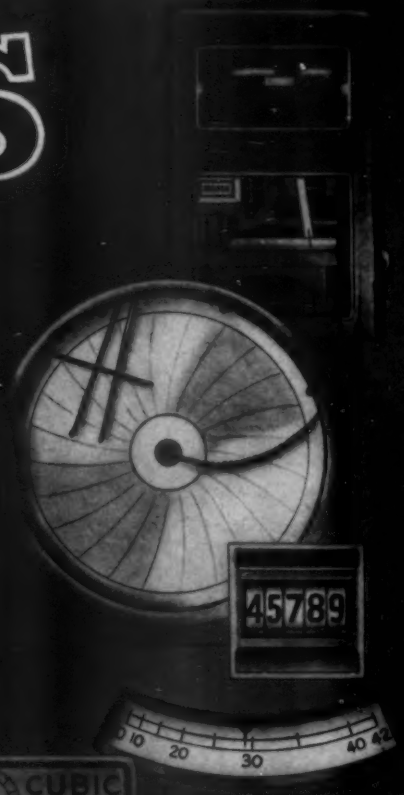
Chicago Pittsburgh

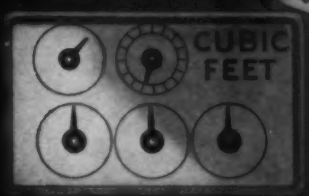
LAVINO GRANULAR OXIDE LAVINO GRANULAR OXIDE


BUILD THE LOAD!
GPM
IRON HYDROXIDE
WILL PURIFY IT
GAS PURIFYING MATERIALS COMPANY
INC.
LONG ISLAND CITY, NEW YORK & PROVIDENCE, RHODE ISLAND

MODERN METERS

AMERICAN METER CO



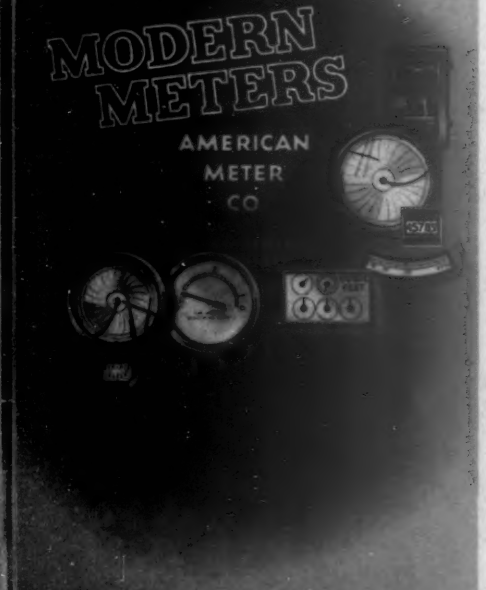


MEASUREMENT

ENGINEERED FOR ACCURACY

AND MAXIMUM RETURN ON YOUR INVESTMENT

THE COST OF ACCURATE MEASUREMENT IS MADE UP OF THE INITIAL COST TODAY PLUS MAINTENANCE COST TOMORROW AND FOR YEARS TO COME . . .



OF VITAL CONCERN to every gas company executive in the country interested in metering costs is the research work carried on during the past four years by American Meter Company.

On tin meters alone, outstanding results have been achieved on the following research undertakings, which are just a few of the many successfully projected:

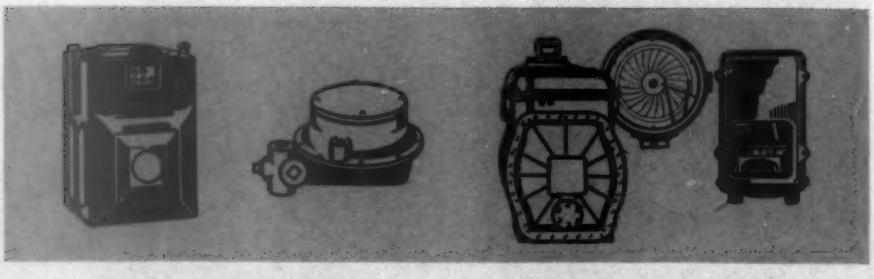
Accuracy at low rates of flow . . . Effect of lost motion and stuffing box friction on proof . . . Bearing corrosion . . . Strength of parts . . . Survey and exhaustive tests of all raw materials, including stuffing box greases, leather treatments, leather substitutes, etc.

●

ON IRONCASE METERS, research has achieved the following noteworthy developments:

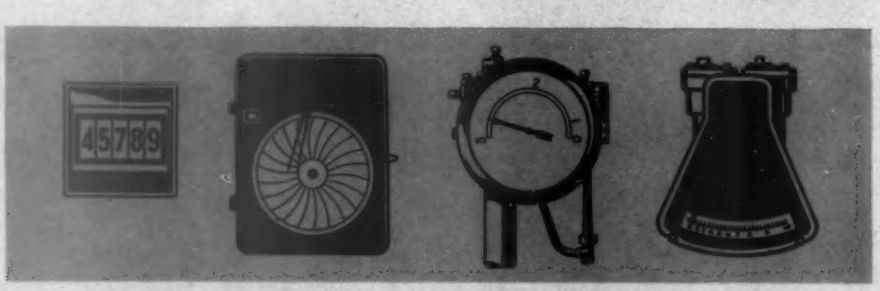
Improvements to h.p. meters including lubrication of all moving parts and protection from dust; Base Pressure and Base Volume Indexes; 500 lb. positive meter, differential valve, etc.

More complete information will be published for the industry shortly.



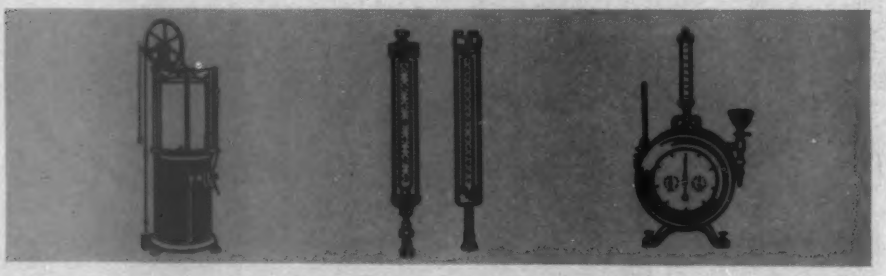
TINNED STEELCASE METERS • REGULATORS • IRONCASE METERS
VOLUME & PRESSURE GAGES • BASE PRESSURE & VOLUME INDEXES

TINNED STEELCASE METERS: Advanced developments in design and construction insuring accuracy on all ranges, including low rates of flow. IRONCASE METERS: The only meter offering one-piece body casting eliminating internal leaks, with a lubrication and dust protecting system in the larger sizes. BASE PRESSURE AND BASE VOLUME INDEXES: Save computing of charts; billing data always ready—always up to date. VOLUME & PRESSURE GAGES: They put your finger on costly load conditions and help you allocate charges correctly. RELIANCE REGULATORS: Appliance, service and industrial types; noted for their patented exclusive features providing positive lockup, accurate pressure control and greatly reduced upkeep cost.



INDICATING, RECORDING AND INTEGRATING ORIFICE AND FLOW METERS
RATE-VOLUME, LIQUID LEVEL AND PROPORTIONAL CONTROLLERS

Developed and manufactured to standards of accuracy established in the measurement of volumes as minute as the gas pilot light's flow. Notable for their extreme simplicity of construction. Fewer working parts. Fewer adjustments required . . . Upkeep costs greatly reduced.



TESTING AND PROVING APPARATUS • GAGES • WET & DRY TEST METERS

American Meter Company proving room and research instruments and equipment are the industry's laboratory standard of accuracy and reliability. Cubic foot bottles, calorimeter, pressure gages, wet and dry test meters, gravitometer and other specific gravity instruments.

Albany Baltimore Birmingham Boston Chicago Dallas Denver Erie Houston
Kansas City Los Angeles Philadelphia New York San Francisco Tulsa
CANADIAN METER COMPANY, LTD., HAMILTON, ONTARIO

AMERICAN METER COMPANY

INCORPORATED

Measurement and control of Gas, Oil, Steam, Air and Liquids

ESTABLISHED 1836

GENERAL OFFICES: 60 EAST 42nd STREET, NEW YORK, N. Y.

Be SAFE- Rely on STEEL PIPE!

CHECK THESE ADVANTAGES

- √ *Reliability.*
- √ *Great tensile strength.*
- √ *A high degree of ductility.*
- √ *Adaptability for any type of joint.*
- √ *Less interruption to service.*
- √ *Lower laying costs.*
- √ *Longer lengths.*
- √ *Fewer joints.*
- √ *Various coatings available for bad soil conditions.*

The greatest asset in any pipe used for gas lines is reliability. This is the main reason why Gas Companies the country over continue to specify NATIONAL Steel Pipe; it is safe, efficient and economical, and can be relied upon to meet the most severe external or internal strains. Vibration (heavy street traffic), caveins, trench pressures, shocks, washouts, settling of filled ground and other factors place a heavy burden on underground lines, yet they are successfully met by the high tensile strength and ductility of NATIONAL Steel Pipe. Put in NATIONAL now and stop those excessive breaks, interruptions to service, loss of gas from defective joints, and high maintenance costs.

NATIONAL Steel Pipe for gas mains is made to rigid specifications by the largest manufacturer of steel tubular products in the world. When you specify NATIONAL, you obtain a product to which the most advanced design and methods have been applied by an organization with the widest experience in pipe problems. Check the list of advantages. Be safe, install NATIONAL Steel Pipe. NATIONAL engineers will gladly discuss with you any question that you may have concerning steel gas mains.

NATIONAL TUBE COMPANY · Pittsburgh, Pa.

Pacific Coast Distributors—COLUMBIA STEEL CO., San Francisco, Calif.

Export Distributors—UNITED STATES STEEL PRODUCTS CO., New York, N. Y.

United States Steel Corporation Subsidiary

STEEL GAS MAINS

"LONG LIFE PIPE"
with gas-tight mechanical joints

Cast iron bell-and-spigot pipe with mechanical joints meets the three major requirements of the distribution engineer—long life, low maintenance and a bottle-tight joint. The stuffing-box type mechanical joint, as made by members of this Association, has been proved gas-tight by rigid tests conducted by the laboratory of the American Gas Association.

The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engineer, 1015 Peoples Gas Bldg., Chicago, Ill.

CAST IRON PIPE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE USEFUL LIFE OF CAST IRON PIPE AT 100 YEARS

EDITOR SEES IT

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n? A decade es were in- riously both- ression. Gas competition in the future. ease our pres- r meter today the cost of gas per M, this in turn being necessary in order to permit rates sufficiently low to enable our industry to meet competition successfully. Hence the large amount of time which the Convention will devote to sales.

Rate forms have an important bearing on sales and the past year has seen some notable developments in that direction. Therefore rates have been included as an important feature in the scheme of things.

Caring for peak loads is another subject the importance of which is not so obvious. It must be remembered, however, that house heating is probably the greatest potential field for increasing gas sales. This load has the advantage of large sales per meter but the disadvantage of high peak loads. It is essential that these peak demands be handled economically if the cost of supplying gas for house heating is to be kept down to a point where it can compete successfully with other fuels.

It would be possible to go on and cite reasons why other papers to be given are timely and how they fit into the general scheme.

The important thing for those who go to Chicago will be to get the broad picture of conditions and trends in the industry, and how in general others have been successful in meeting their problems. An attempt to absorb too many details while there will merely narrow your viewpoint. You can study the papers and proceedings afterwards if you have occasion to.

Today, as never before our industry needs men with clear minds and broad vision. The convention offers each man the opportunity to develop these qualities.

The Cooperative Radio Program

ANNOUNCEMENT by a group of gas companies located in the New England and the Middle Atlantic States that plans have been perfected for a series of cooperative radio broadcasts featuring Mr. John Macpherson, "The Mystery Chef," is indeed welcome news.

"I have no detailed proposal to submit at this time," said President F. M. Goodwin at the Annual Business Conference of the New England Gas Association last February, "but I do think that the possibilities of a substantial number of New England companies getting together on a cooperative advertising campaign, including newspaper or radio or both, should be considered." This idea, in so far as it applies to radio, is about to become an accomplished fact, and will be on a somewhat larger scale than President Goodwin contemplated.

Our industry has been wise in waiting until it could put on a series of programs that would be appropriate and have an assured popular appeal. Few men perhaps have heard of "The Mystery Chef"; but he has proved beyond question that he can gather an ever increasing audience of women because he tells them in a practical but inimitable way how to cook success-

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"LONG LI

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The Cast Iron Pipe Research Ass'n, Thos. F. Wolfe, Research Engi **ago, Ill.**

CAST IRON PE

METHODS OF EVALUATING BIDS NOW IN USE BY ENGINEERS RATE THE IRON PIPE AT 100 YEARS

AS THE EDITOR SEES IT

The A. G. A. Convention

ANOTHER year has passed, and the time has again come for the Annual Convention of the American Gas Association. There is perhaps a little less ballyhoo than on other occasions. For reasons of economy there will be no colorful exhibit by the manufacturers of equipment and appliances. There will be the usual enjoyable evening entertainment. However, this Seventeenth Annual Convention is likely to be remembered as a business meeting and as an occasion at which the problems confronting the industry were seriously considered.

The real purpose of a convention should be to give a broad view of conditions in the industry as a whole, and to afford opportunity for a discussion of the best means of handling each of its salient problems. Each paper and discussion should be a part of a coordinated program, a section of a composite picture. Too often, however, the individual fails entirely to perceive this. He listens to what seems to him a series of disconnected talks. In some he is greatly interested, particularly if they touch on the details of a problem with which he is immediately confronted; in others he may see little which has immediate application to his work or situation. Too often he returns home with recollections of a good time, with a little more specialized knowledge but with no broader vision of the problems likely to beset his company in the future or how to prepare to meet them.

The program of the A. G. A. Convention shows thought in its preparation. It indicates a real vision of the present and future problems of the industry. Virtually every paper has a place in the broad scheme of things.

At the first General Session the President, Mr. P. S. Young, will outline the situation in which the industry now finds itself and will undoubtedly sketch a broad picture such as we have mentioned. Mr. Young's address will be a vital part of the Convention program.

Thereafter details will be added piece by piece. Sales promotion, rates, taxation, handling peak loads, as well as sundry technical and accounting problems will each have an appropriate place in the general scheme.

Building up the volume of gas sales is unquestionably the greatest problem before us. At least half of the papers to be read deal with sales promotion or related subjects. Even the Technical Section has a symposium on "Employee's Part in Increasing Gas Usage and Appliance Sales," a bold though timely departure from its traditional sphere.

Why this concentration on sales promotion? A decade ago the country was prosperous. Gas sales were increasing satisfactorily, and we were not seriously bothered by competition. Then came the depression. Gas sales fell off. Also, we are now faced with competition which is likely to become even more keen in the future. We must fight if we are to hold and increase our present business. In fact increased sales per meter today seems the most feasible way of reducing the cost of gas per M, this in turn being necessary in order to permit rates sufficiently low to enable our industry to meet competition successfully. Hence the large amount of time which the Convention will devote to sales.

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"I have no detailed proposal to submit at this time," said President F. M. Goodwin at the Annual Business Conference of the New England Gas Association last February, "but I do think that the possibilities of a substantial number of New England companies getting together on a cooperative advertising campaign, including newspaper or radio or both, should be considered." This idea, in so far as it applies to radio, is about to become an accomplished fact, and will be on a somewhat larger scale than President Goodwin contemplated.

Our industry has been wise in waiting until it could put on a series of programs that would be appropriate and have an assured popular appeal. Few men perhaps have heard of "The Mystery Chef"; but he has proved beyond question that he can gather an ever increasing audience of women because he tells them in a practical but inimitable way how to cook success-

fully and how to economize in the choice of foods. During the four years that he broadcasted for the Davis Baking Powder Company he received letters from one out of every four families in the United States. Official figures of the National Broadcasting Company show that his station mail response in one month was equal to the total mail response from four other cooking talks for an entire three-year period.

The interest which gas companies have shown in this project is evidenced by the number that have given assurance of their support. In the territory to be covered by the broadcasts there are approximately 6,000,000 domestic gas meters. It was decided that the plan would be carried out only if companies supplying at least 75 per cent of these would participate. This quota was secured on September 21. The latest figures show that 60 companies with a total of 4,839,211 domestic meters have given assurance of their support. New names are being added to the list daily. Large and small companies alike appear to recognize this as a real opportunity and are preparing to take advantage of it.

Some may regret that this project is not nation-wide. We feel that the territory to be covered is plenty large enough. There will be a total of thirteen stations that will broadcast the programs, and it is estimated that these reach 6,826,000 homes with radio sets. If conditions warrant, additional companies and stations may be added at the end of the initial contract, which is for one year.

Two fifteen-minute broadcasts each week, or a total of 104 over the entire network of stations would seem to be adequate during the first year at least. Wednesday and Friday mornings from 10:30 to 10:45 are the periods selected; and it is planned to have the initial broadcast on November 1.

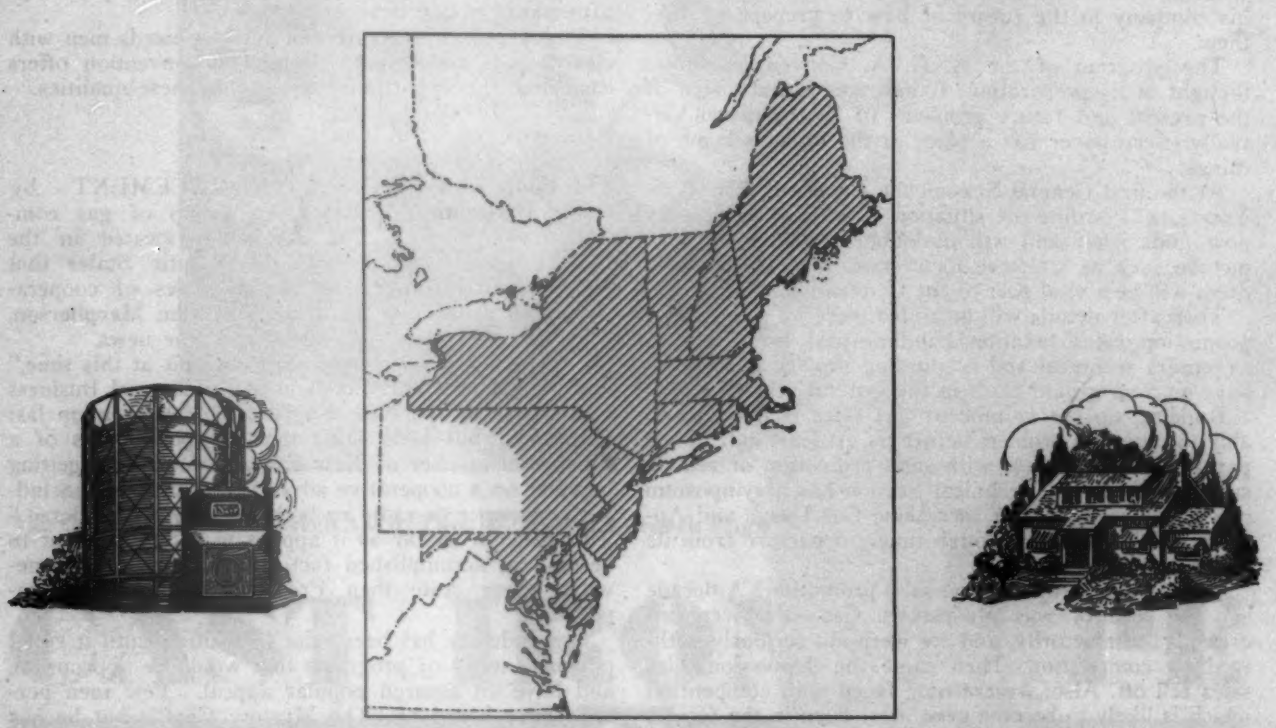
It is to be expected that the principal theme of the talks will be cooking by gas, but constant reference will be made to refrigeration, water heating and house heating. The object, of course, will be to create a strong customer preference for gas service.

A recipe book, prepared by "The Mystery Chef" and containing all of his most popular recipes, will be an integral and inseparable part of the whole project. It is also planned to devote several pages of the text to domestic applications of gas, recent improvements in appliances, etc. The use and distribution of the recipe book and any of its contents will be restricted to companies supporting the broadcasts. The number of requests for the book will serve as a barometer of the success and effectiveness of the programs.

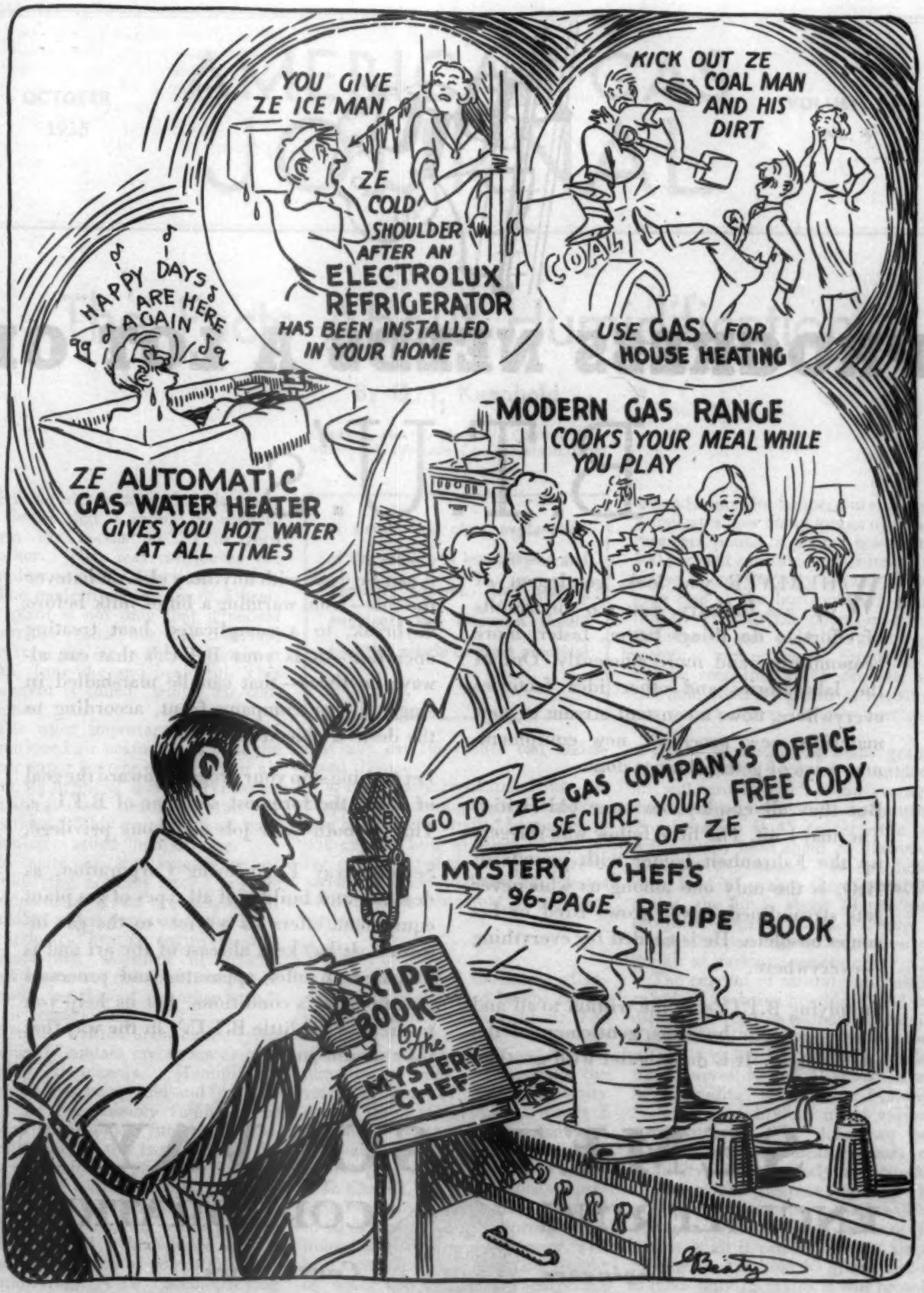
Due to the number of companies which are cooperating the cost of this project is very moderate. For the 13 radio stations for 104 fifteen-minute broadcasts and for Mr. Macpherson's services the cost will be about 2.4 cents per domestic meter. If more companies participate the cost per meter will be even lower. In any event it is an excellent example of the economies often possible through cooperation.

While this whole matter will henceforth be handled by a committee consisting of representatives from some of the member companies, credit for having initiated the idea and for having done the organization work rightfully belongs to the American Gas Association.

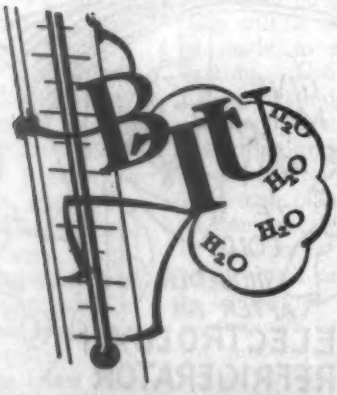
Our industry is sometimes accused of being ultra-conservative. Even in embarking on this project it has been conservative, and rightly so. It waited until appropriate talent of unquestioned merit could be obtained and until a full measure of support from the gas companies was assured. Having secured both of these, it has adopted the most modern publicity methods and can now go forward with confidence.



Territory Covered by Radio Program Which Will Be Broadcast Over Following NBC Network: WEAF, New York; **WEEI,** Boston; **WTIC,** Hartford; **WJAR,** Providence; **WTAG,** Worcester; **WCSH,** Portland; **KYW,** Philadelphia; **WFBR,** Baltimore; **WRC,** Washington; **WGY,** Schenectady; **WBEN,** Buffalo; **WHAM,** Rochester; **WSYR,** Syracuse.


YOU GIVE ZE ICE MAN ZE COLD SHOULDER AFTER AN ELECTROLUX REFRIGERATOR HAS BEEN INSTALLED IN YOUR HOME
KICK OUT ZE COAL MAN AND HIS DIRT
USE GAS FOR HOUSE HEATING
HAPPY DAYS ARE HERE AGAIN
ZE AUTOMATIC GAS WATER HEATER GIVES YOU HOT WATER AT ALL TIMES
MODERN GAS RANGE COOKS YOUR MEAL WHILE YOU PLAY
GO TO ZE GAS COMPANY'S OFFICE TO SECURE YOUR FREE COPY OF ZE MYSTERY CHEF'S 96-PAGE RECIPE BOOK
RECIPE BOOK by the MYSTERY CHEF

Group of Gas Companies Cooperate in Sponsoring Series of Radio Programs Featuring the "Mystery Chef"



PROGRESS NEEDS A LOT OF B.T.U.'s

WHEREVER you look, gentlemen of the gas industry, you see the results of effort to do things better, faster, more economically, and more efficiently. Out of the laboratories and other idea factories everywhere, flows a constant stream of new materials, new processes, new equipment, new ways of getting things done.

But they all employ the same old British Thermal Unit. The little fellow who staggers up the Fahrenheit ladder with pounds of H_2O, is the only one among us who never gets streamlined, never grows tired or becomes obsolete. He is needed for everything —everywhere.

Supplying B.T.U.'s by the trillion to all and sundry is your business, gentlemen of the gas industry. It is done better with gas than it can be done with anything else. Whatever the job—from warming a bit of milk before daybreak, to a complicated heat treating operation—it is your B.T.U.'s that can always be there—that can be marshalled in single file or company front, according to the desired objective.

Let nothing stop your progress toward the goal of being the foremost supplier of B.T.U.'s. That is both your job and your privilege.

Semet-Solvay Engineering Corporation, as designer and builder of all types of gas plant equipment, offers its services to the gas industry. It has kept abreast of the art and is prepared to offer apparatus and processes that fit today's conditions. Let us help you to prepare the little B.T.U.'s in the way that they should go.

SEMET-SOLVAY ENGINEERING CORPORATION

Engineers *Contractors*

40 RECTOR ST. NEW YORK, N. Y.

OCTOBER
1935

AMERICAN GAS JOURNAL

VOLUME 143
No. 4

The Facts About Humidification

By O. J. Kuenhold

Engineer, Heat & Humidity Control Div.,
Monmouth Products Co., Cleveland, Ohio

A simple and clear explanation of the science of humidifying and humidity control. Gas heating engineers and salesmen should find this article of great practical value.

THE old idea of a heating plant was simply that it should be able to warm the rooms to 70 in zero weather. That was considered the complete and only function.

The modern conception of a heating plant is not only that it should warm the rooms, but that it should also treat the air in them to make it clean. June-like and healthful. This treatment is called "winter air conditioning."

The most important function of conditioned air heating is to raise the water vapor content of the indoor air from its artificial winter dryness to a natural and healthful state of moistness. This portion of air conditioning is called "humidifying."

In spite of the importance of humidifying, not only from a hygenic standpoint but from a standpoint of available added profits for the heating industry, heating engineers, contractors and salesmen in general know less about the fundamentals of humidifying than of any other branch of air conditioning.

Articles written upon humidifying frequently contain erroneous or misleading statements. Humidifying equipment is being sold and installed that can not possibly fulfill its intended and claimed functions. Unquestionably all this has held back the general public acceptance of humidification for homes in winter.

To clear up the existing confusion and misunderstanding which prevails and to spread a knowledge of the fundamental facts of domestic winter humidifying, the accompanying charts and explanation were prepared. These, for the first time, make the science of humidifying and humidity control so clear and simple that any careful reader can understand them.

We earnestly recommend that the charts and accompanying explanation be carefully studied because they will explain how to select humidifying equipment that will give perfect satisfaction and to know the causes of trouble in those that do not give satisfaction.

Outdoor Humidity

The condition of moistness of indoor air is determined by the condition of moistness of outdoor air. For this reason it is necessary to understand certain facts about *outdoor* humidity in order to understand the essential facts of *indoor* humidity during the heating season. Chart I graphically portrays the fundamental facts about outdoor humidity clearer than is possible in any other way.

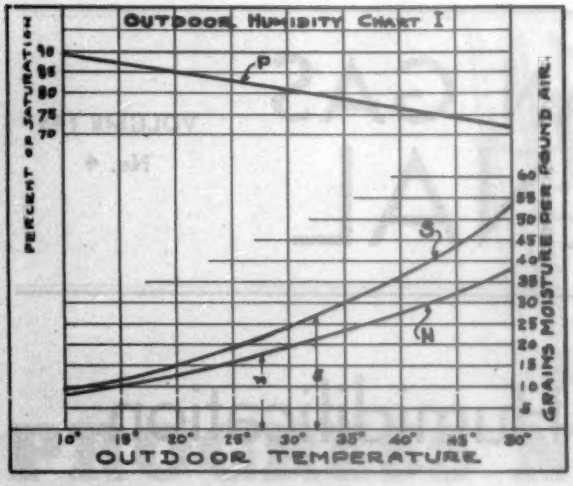
In Chart I, the vertical lines represent outdoor temperatures from 10 to 50 degrees—weather during which indoor humidifying is necessary. The horizontal lines represent the weight of water vapor held by each pound of air—a grain being one 7000th of a pound.

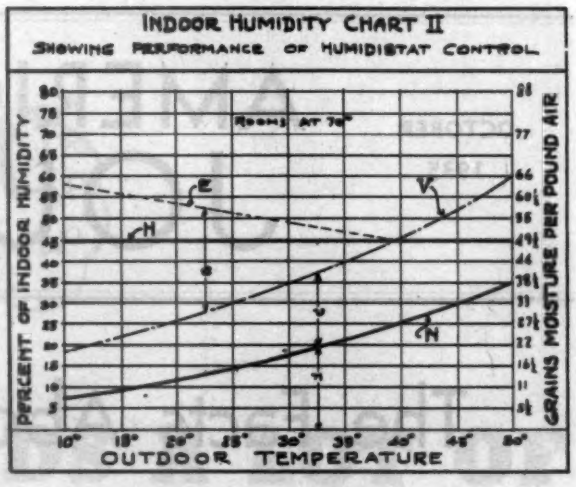
The maximum weight of moisture which air can hold when saturated depends upon its temperature. Curve S indicates how many grains of moisture each pound of air can hold when 100 per cent saturated. For instance, Curve S crossing the vertical 20 degree line at the horizontal 15 grain line shows that each pound of air at 20 degrees can hold 15 grains of moisture, and no more. Similarly, it can be seen that at 45 degrees, air can hold about 44 grains of moisture per pound, when 100 per cent saturated.

Curve N shows how many grains of moisture each pound of outdoor air will actually hold, on an average, during various outdoor temperatures. For instance, at 45 degrees, the air will actually hold about 33 grains of moisture per pound. It can however, hold 44 grains, therefore at 33 grains, the air is about 74 per cent saturated with moisture. Curve P shows the per cent of saturation of the air at various temperatures.

The percent of saturation of air is called its "relative humidity" and indicates the relative wetness of the air. Th grains of moisture in each pound of air is called its "absolute humidity," Curves N and S show "absolute humidity" while curve P shows "relative humidity" of air at various temperatures. The difference between these two measurements of humidity must be clearly understood:

Air at 20 degrees, holding 15 grains of moisture per pound, will be 100 per cent saturated because 15 grains is all it can hold. But air at 50 degrees can hold 53 grains and if it holds only 15 grains it will be only 15/53 or 28 per cent saturated. If warmed to 70 degrees, air can hold 110 grains of moisture per pound and if it actually holds only 15 grains, it





will be only 15/110 or 13.6 per cent saturated, which is very dry.

Remember that it is the per cent of saturation, called "relative humidity," that indicates the condition of moistness of the air. The absolute humidity merely shows how many grains of moisture is contained in each pound of air. Note in Chart I that as air gets colder the per cent of relative humidity (Curve P) goes upward and the grains of moisture contained in each pound of air (the absolute humidity) goes downward as shown by curve S.

Indoor Humidity

All indoor air originates from outdoors by leakage or otherwise. After air gets indoors it will still hold exactly as many grains of moisture per pound as it held while outdoors, regardless of how much it may be warmed and expanded, provided of course that no moisture is added to the air after it gets indoors.

Chart II tells the basic facts about indoor humidity which must be understood before you can understand winter humidifying. Since the grains of moisture per pound of air will be exactly the same indoors as outdoors at any given outdoor temperature, Curve N of Chart II is exactly the same as Curve N of Chart I, except that it is drawn to a slightly different scale.

Chart II assumes the indoor air warmed to 70 degrees, regardless of outdoor temperatures. The horizontal lines are marked at the right to show the grains of moisture per pound of indoor air and at the left to show the corresponding relative indoor humidity. For instance, in 45 degree weather the air will average 33 grains of moisture per pound. Since air can hold 110 grains per pound when warmed to 70 degrees the indoor air will be 33/110ths or 30 per cent saturated. That is, its relative humidity will be 30 per cent, as shown by Chart II.

Note that while outdoors, at 45 degrees, the air was about 74 per cent saturated, (See Chart I.) When it got indoors, its absolute humidity remained the same but, because it was warmed to 70, its relative humidity decreased to 30 per cent. Similarly, it can be seen from Charts I and II that outdoor air at 20 degrees averages 85 per cent relative humidity but that, during such weather, indoor humidity will average about 12%. This is extremely dry and explains why it is necessary to humidify indoor air in winter.

Curve N of Chart II is very important because it shows the per cent of *indoor* humidity existing during various *outdoor* temperatures and this forms the starting point from which the humidity is to be built up by added moisture.

Curve V is another important curve. It shows to what per cent the indoor humidity can be raised, during various outdoor temperatures, to reach the point at which moisture begins to condense on ordinary windows, having single thickness of glass. For instance Curve V shows that during 30 degree weather, the windows will be cold enough for vapor to appear when the indoor humidity has been raised to 35 per cent, corresponding to 38½ grains of moisture per pound of indoor air.

When indoor humidity, during any given outdoor temperature, is raised higher than the per cent of humidity indicated by Curve V for that outdoor temperature, condensation at windows will increase. If the indoor humidity is raised very much above the percent indicated by Curve V, the window condensation will become excessive and very objectionable to home owners. The practical high limit for indoor humidity is therefore indicated by Curve V and this cannot be greatly exceeded without incurring complaints.

The distance v, from base Curve N to Curve V, will indicate accurately how many grains of moisture must be evaporated into the indoor air for each pound of air that leaks into the house, if no appreciable amount of window condensation is to be incurred.

When the preceding facts about air humidity are understood you will be equipped to judge the advantages and disadvantages of various methods of indoor humidifying and humidity control, which will now be explained.

Humidistat Control

Humidistats, which are generally electrical instruments, hold the indoor humidity static at whatever per cent the instrument is set by the owner. Usually it is recommended that 45 per cent humidity be maintained. Let us now see exactly what occurs when this is done. Chart II tells the whole story.

The line H indicates 45 per cent indoor humidity maintained, in all weather. When outdoor temperature is 40 degrees, note that the 45 per cent of maintained indoor humidity will result in vapor just beginning to appear at the windows. This is O.K. but note that as weather gets colder, the line H, (showing maintained indoor humidity) will be an increasing distance above Curve V (which indicates the per cent of indoor humidity at which window condensation begins). This plainly shows that window condensation will increase rapidly as weather gets colder, becoming very excessive in extremely cold weather.

When moisture is thus condensed out of the indoor air, this tends to reduce indoor humidity, but as the humidistat is set to maintain 45 per

cent indoor humidity, it will automatically cause evaporation of moisture into the indoor air to be increased to replace any moisture that is condensed at windows. This increases window condensation to distance, from Curve V to Curve "E." The result, in extreme weather, will be a stream of water trickling down the windows and overflowing at the sills down the wall paper to the floor.

This plainly proves that with ordinary single glass windows, it is entirely impractical to maintain anywhere near 45 per cent indoor humidity or to evaporate anywhere near the 18 to 20 gallons of water per day per 10 thousand cubic feet of air leakage per hour that is recommended in many text books and articles upon domestic humidifying.

The only remedy, when a humidistat is employed to control indoor humidity in homes having single thickness glass windows, is to constantly reset the humidistat to maintain lower humidity as weather gets colder and higher humidity as weather gets warmer. Humidistats therefore, do *not* automatically maintain the desired per cent of humidity in homes, as is commonly imagined and is generally expected by purchasers.

Aside from causing excessive window condensation, humidity should not be maintained as high as 45 per cent in extreme weather because clothes will instantly become moist upon going outdoors.

Float Controlled Evaporating Pans

Evaporating pans having a float to maintain constant water level therein are widely sold as "automatic" humidifiers. Chart III graphically shows how improperly such pans control indoor humidity. Curves N, showing the indoor humidity that prevails in winter when no moisture is added to the indoor air, is the same as Curves N in Charts I to IV. Curve V showing the per cent of indoor humidity at which window vapor begins to appear is the same as in Charts II and IV.

Curve F indicates the amount of water evaporated into the indoor air by a float pan, assuming the pan as having enough water surface to evaporate sufficient water to raise the indoor humidity to 35 per cent when the furnace is operated at a rate of combustion that will raise the room temperature to 70 in 30 degree weather.

In colder weather the furnace will have to be operated at a higher rate of combustion. This increases the dome and evaporating pan temperature. The amount of water evaporated will therefore increase rapidly as shown by Curve F. This results in excessive window condensation, the excess being indicated, at various outdoor temperatures, by the vertical distance that Curve F is above Curve V. On the other hand, in weather warmer than 30 degrees, the furnace dome will not be hot enough to evaporate sufficient water to raise the indoor humidity as much as is required.

To remedy the excessive humidity maintained by a float pan of large evaporative capacity, a smaller evaporating pan is sometimes installed. The results then obtained are indicated by Curve F′, in which example the evaporation will be about right at 20 degrees outdoor temperature, too much in colder weather and not enough in milder weather. The per cent of indoor humidity maintained by float plans will be slightly lower than that indicated by Curves F and F′, when weather is colder than the outdoor temperature line at which Curves F or F′ cross the window vapor Curve V. This is due to the dehumidifying effects of window condensation.

Thermostat Controlled Evaporating Pans

Evaporating pans are also employed which have thermostatic water feed control. The thermostatic mechanism opens the water feed valve more as the furnace dome gets hotter. This is exactly what is *not* wanted. The results as to room humidity maintained are very similar to the results obtained from float controlled evaporating pans and just as bad. Any float or thermostatically controlled pan that does not give excessive window condensation in the colder weather is certain to be of entirely inadequate capacity for the milder winter weather.

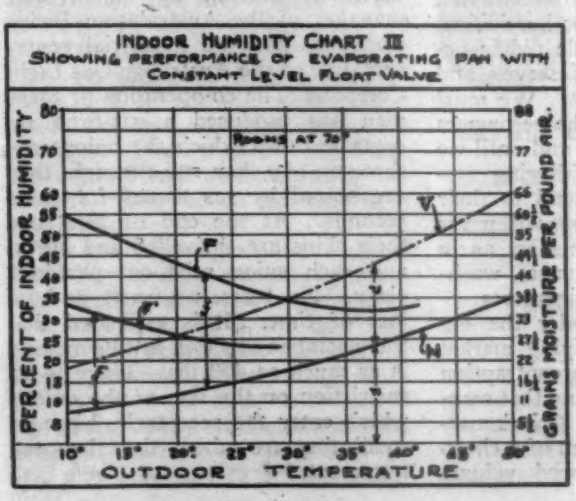
Control By Constant Rate of Water Feed

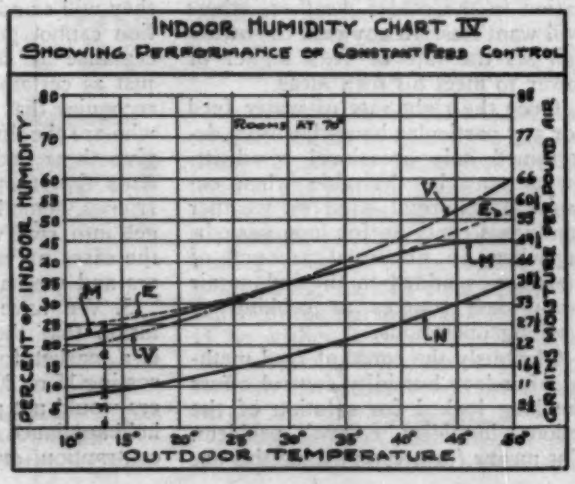
The results obtained by feeding water into an evaporating pan of adequate capacity at a constant but correct rate in all weather are plainly shown in Chart IV.

Curve N shows the natural indoor humidity that will prevail in winter if no humidifying is done. If we feed water to the evaporating pan at a constant rate in all weather we shall increase the indoor humidity above the natural humidity by a certain constant per cent.

For instance, if, in any weather, we add moisture to the indoor air at a constant rate represented by distance "e" in the chart, we shall raise the humidity from that shown by Curve N to that shown by Curve E. In Chart IV, distance "e" represents the addition of 19¼ grains of moisture for each pound of air that leaks in from outdoors. In other words, it represents the evaporation of about 6 gallons of water per day for each 10,000 cubic feet of in-leaking air per hour.

When this amount of water is evaporated into the indoor air, the relative indoor humidity will be in-


INDOOR HUMIDITY CHART III
SHOWING PERFORMANCE OF EVAPORATING PAN WITH CONSTANT LEVEL FLOAT VALVE
ROOMS AT 70°
PERCENT OF INDOOR HUMIDITY
GRAINS MOISTURE PER POUND AIR.
OUTDOOR TEMPERATURE


INDOOR HUMIDITY CHART IV
SHOWING PERFORMANCE OF CONSTANT FEED CONTROL
ROOMS AT 70°
PERCENT OF INDOOR HUMIDITY
GRAINS MOISTURE PER POUND AIR
OUTDOOR TEMPERATURE

creased by 17½ per cent points over and above the natural humidity that would otherwise exist. In 30 degree weather, the indoor humidity will therefore be raised from the natural humidity of 17½ per cent for 30 degree weather to 35 per cent, which is just to the per cent when window vapor will begin to appear, as is shown by Curve V.

As weather gets colder than 30 degrees, the window vapor point will gradually descend below the theoretically maintained humidity, shown by Curve E. The slight window condensation or frost which appears will, by extracting moisture, reduce the theoretically maintained humidity to curve M which shows the actually maintained humidity. In weather warmer than 35 or 40 degrees, the furnace will not be hot enough to evaporate all the water which is fed to the evaporating pan. The indoor humidity that is maintained in the warmer weather will therefore be as shown by Curve M for 40 to 50 degree weather. This prevents excessive indoor humidity in mild weather and is automatically accomplished by proper proportioning of the evaporating surface of the pan.

The scale of indoor humidities for various outdoor temperatures which naturally result from the constant water feed and shown by Curve M are ideal in every way. In the warmer weather the indoor humidity is automatically limited by proper water pan capacity and in colder weather the evaporation is limited by the rate of water feed. This naturally prevents indoor humidity from getting too low in extreme weather, at some sacrifice of window clarity. This is as it should be.

To secure the ideal results shown by Curve M, the owner merely sets the rate of water feed to a point that will give him satisfactory results in all weather. Some owners may be willing to have more window condensation in the colder weather, others will want less. In any case the owner can set the rate of feed higher or lower to meet his own ideas.

Once the right rate of water feed for any particular house has been determined only occasional re-adjustments may be desirable when occasional abnormal wind or weather conditions continue for long periods, or when an abnormal amount of moisture is added to the indoor air from such sources as cooking or washing operations.

Obviously the constant feed method of indoor humidity control offers the long looked for solution of the indoor humidity control problem. The means for accomplishing this are far simpler than the explanation of the principles by which it is accomplished. No automatic increase or decrease of the rate of water feed to the evaporating pan is necessary. Simply feed the water to the pan at a steady but correct rate and the per cent of indoor humidity will be naturally modulated so that the highest practicable humidity will be maintained in any weather without incurring excessive window wetness.

General Review

Successful humidification of the air in homes during the heating season necessitates that certain very important facts are recognized. In spite of these important facts being perfectly obvious they have been almost universally overlooked.

1. Means to humidify without means to properly control the indoor humidity are as useless as a furnace without means to control its heat delivery.

2. Practically all homes have single thickness glass windows. These will condense moisture to an increasing extent as the weather gets colder, unless the indoor humidity during any outdoor temperature, is held down below the per cent at which excessive window wetness occurs.

3. Home owners positively will not stand for excessive window wetness. Neither will they go to the considerable expense of installing double windows to avoid it. Neither will they constantly re-adjust a humidity control to comply with weather changes so as to hold window condensation down.

4. It is not theory but the home owner that must be satisfied. To lay down a rule that indoor humidity should be maintained at for instance, 45 per cent, is very plainly impractical, yet it is done every day. Until we give home owners humidifying systems that automatically control the indoor humidity within limits that they will stand for, home humidification cannot get the wide public acceptance it certainly deserves and just as certainly can get. We *must* recognize that it is the home owners who are the final judges and until we give these judges humidifying systems that they recommend to their friends, home humidifying will never get into real volume business as in the cases of vacuum cleaners, washers and mechanical refrigerators.

5. We have been under the delusion that the humidifying market is a market for a cheap contraption costing 15 or 20 dollars and that owners would not pay more. No household appliance in the form of a cheap contraption *ever* developed volume business. The radios, vacuum cleaners, washers and mechanical refrigerators which are sold by millions are not cheap contraptions. There is neither profit nor satisfaction for jobber, dealer or purchaser in a cheap make-shift humidifier. True, there is a limit that people will at present pay for a humidifier but it is equally true that home owners will much more readily purchase a scientifically designed and built humidifying system at two or three times the price of a cheap humidifier. Such a humidifying system, by giving satisfaction, will bring more orders from friends of purchasers and will bring a worthwhile profit to dealers. Clearly, the way to volume business and profits is to sell better humidifying systems.

6. The sixth point that has been overlooked is that every *good* humidifying system that is sold for warm air heating plants is the first step of the owner toward installing complete air conditioning. It is the entering wedge for more business, if the humidifying means include control means satisfactory to the owner.

Make no mistake. Humidifying presents to the heating industry a very large market if this potential market is cultivated in the right way.

Peeling Onions by Gas
Recent Australian Invention

Until recently, Australian pickle factories held dozens of girls who wept incessantly during the preparation of the onions. The process was slow and painful. The girls could hardly see what they were handling—their eyes were so blurred that there was a great deal of fumbling and unavoidable clumsiness in their work so that the output of the factory was considerably hindered.

This old-fashioned and unprofitable method of hand peeling has now been successfully eliminated by an invention evolved by the Works' manager of the Australasian Pickle Company and the industrial representative of the Australian Gas Light Company. The co-operation of these men has produced a gas-fired receptacle down which the onions are thrown. As they roll through, they are seared by gas flames for three seconds. At the end of this time their skins are shrivelled and burnt, and each onion rolls out perfectly clean. No tears, no waste and no loss of time. It is estimated that the wastage reduction in this method is as much as 400 lbs. There is no restriction on the size of the onions which enter the receptacle, large or small, they are subjected to the same treatment.

Increasing House Heating Installations

With Rental Sales Plan and Guaranteed Bills

By Geo. H. Watson

GUARANTEED heating bills plus a rental-sales plan on conversion burners are two effective weapons being used by the Birmingham Gas Company in a frontal attack on the home heating market in "The Pittsburgh of the South," where coal is cheap and plentiful.

Aggressive methods are used because of competitive conditions and the fact that gas for house heating is still relatively new in Birmingham. First efforts to sell gas heating for the home were made in 1925, but gas then sold for 80 cents per 1,000 cubic feet within the city and $1.20 outside the city limits, compared to the price of 38 to 40 cents per 1,000 cubic feet now for 530 B.T.U. gas.

When the Birmingham Gas Company was organized in 1929 and took over the gas operations of the Birmingham Electric Company there were less than 100 houses heated by gas in the city. In 1930 the utility organized a house heating department with some 35 salesmen and succeeded during the year in selling some 500 jobs, about one-third of which turned out to be repossessions. Then came the worst depression in years and the department was largely suspended. In 1934 two men with many duties in addition to househeating sales sold 81 jobs. This year four salesmen and one engineer comprise the house heating department and they expect to sell at least 150 jobs, running about 50 per cent conversion burners, 20 per cent gas designed boilers or furnaces and 30 per cent combination space heaters, heatrolas and floor furnaces. These men will sell water heaters and radiant fires during the months when house heating sales are lowest.

The guaranteed gas bill has helped the utility to meet competition from coal dealers who sell wagon mine coal as low as $2 a ton and help spread the belief that gas heat is "too expensive." "The average family can afford gas heat" is the battle cry of the utility which also has the greater cleanliness of its fuel to offer, plus free service on the equipment after it is installed. Neither have the coal companies been able to get very far with their cry of "patronize a home industry," since the Birmingham Gas Company uses a product manufactured from local coal.

The guarantee is to the effect that the engineer's estimate of the gas bill for house heating will not be exceeded by more than 10 per cent during the first year of trial, the heating season being figured from Oct. 15 to May 15. Estimates are based on the formula of the American Gas Association, plus a corrective factor based on "degree-hours" found to apply in Birmingham. The normal heating season in Birmingham contains about 2,550 degree days.

You can **RENT**
A GAS BURNER *for your furnace*
LIKE YOU RENT A BOOK

AVERAGE FAMILY CAN EASILY **AFFORD** GAS HEAT

$3.50 per month

GAS BILL ESTIMATE *Guaranteed*

BIRMINGHAM *Gas* COMPANY

In making an estimate for a house the engineer takes into consideration the average for other similar houses with actual installations and then 10 per cent is added to the average. The heating bill is then guaranteed not to exceed 10 per cent of the figure thus derived, which means that the utility has in effect a 20 per cent leeway. Of 81 installations made in 1934, the bills ran more than 10 per cent of the estimate in only four cases, the total refund being less than $25.

Actual gas bills on home heating are checked each month with the guaranteed estimate. If the actual bill runs more than the estimate then an engineer goes out pronto, even before the owner receives the bill and makes a check. It may be that a defect may be found in the heating system or that the owner is allowing the temperature to run too high in the house. The estimate calls for 72 degrees of temperature during 16 hours of the day and 65 degrees at night or during the other hours, this being considered suitable for the average winter temperature in Birmingham. If the engineer suspects that the owner is operating at an excessive temperature, he places a recording thermometer in one of the rooms for a check. In this way the source of excessive bills can be found in the beginning and remedied instead of waiting until the end of the heating season.

Figures taken from the company's records show the following average heating costs in Birmingham.

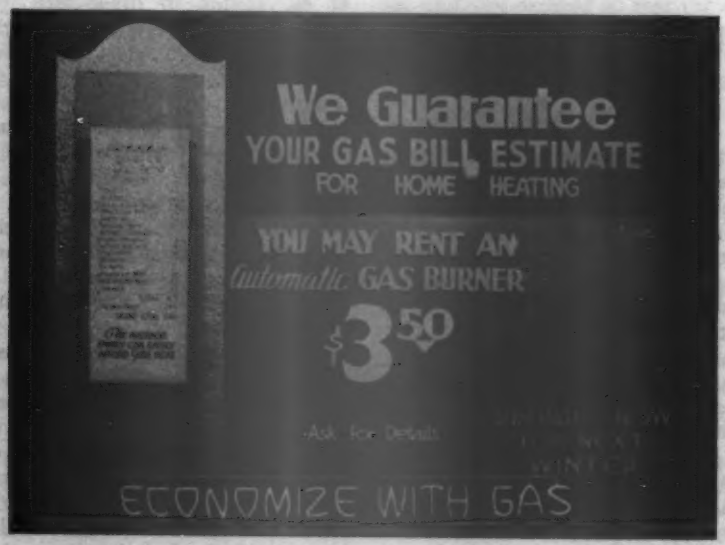
Size of House	*Annual Heating Bill*
One-story, five-room house	$ 70.00
One-story, six-room house	85.00
One-story, seven-room house	105.00
Two-story, seven-room house	115.00
Two-story, eight-room house	130.00

Under the rental-sales plan the company offers to transform the existing furnace or boiler into an automatic gas heating plant for as little as $5.00 down, and $3.50 rental per month, payable only during the heating season. If the owner likes gas heating, he can then apply the rental to the purchase of the burner. If he wishes it removed after trial, the company will restore the furnace to the same condition it was before the conversion.

House heating salesmen are paid on a basis of $75 per month, plus

15 per cent of the annual gross revenue added by each. A seven per cent merchandise commission is also paid on gas designed furnaces and boilers, but not on conversion burners.

The company has a file of some 4,000 persons quoted during the past



few years on gas heat. These names are distributed in small batches from time to time to salesmen for solicitation. Numerous prospects are also obtained from company newspaper advertising, window displays and from employe tips. Employes are paid $2.50 on each conversion burner and $5.00 on each furnace or boiler sold to a prospect furnished by them. Salesroom and office employes as well as meter readers are a fertile source of prospects. With all these contacts house heating salesmen find it unnecessary to do any cold canvassing or door bell punching.

As a sales help photographs of houses where gas heating has been installed are displayed in the show room with a notation as to the owners and the amount of the annual heating bill. Prospects are invited to call these home owners if they wish and get the owners' word themselves as to the cost of the operation. In addition the company occasionally sends out letters to owners, enclosing a card asking for any complaints as well as names of prospects. The number of complaints in such cases has been few, and the number of real prospects quite satisfactory. In one batch of 700 letters which went out, only three complaints were received.

Motion Picture Helpful

The company has also found technicolor motion pictures quite helpful in selling house heating. This year a color film lasting for one minute has been produced and shown regularly in the leading theatres. Scenes in a typical gas-heated home are shown as the family awakes and as the husband "fires the furnace" by the simple expedient of adjusting a thermostat.

In calling on a prospect the salesman seeks permission to make a "house heating survey." This survey includes a wealth of information including the type of heating system in use, diagram of the house and the piping system. With this information the engineer makes a complete estimate of the cost of installing a conversion burner, boiler or furnace as the case might be. The salesman then goes back armed with a concrete proposition. Provided the prospect is willing to buy, the engineer then goes out and rechecks the house to catch any possible errors made by the salesman.

The gas company has been careful in taking contracts and has not attempted to sell gas as a cure-all for heating ills. Where furnaces were found too small, radiation insufficient or other defects in the heating system, the owner was so notified. All installations are made by the service department of the gas company and care in this respect has helped to eliminate complaints. The furnace is lighted up for the customer and tried out before the representative of the gas company leaves.

For the past five years the gas company has provided a free Summer inspection service on all existing installations. In this service, which will be continued in the future, the entire heating plant is checked, the inside of the boiler or furnace cleaned out, the flue and chimney examined and electrical and gas connections adjusted. This free inspection leads to additional sales and has been quite helpful in meeting competition from oil burners and coal stokers on which this type of service is not extended.

House heating activities of the Birmingham Gas Company are carried out under the direction of W. A. Hudson as general sales manager; George W. Loeffel, domestic sales manager, and George T. Stafford, Jr., house heating engineer.

"So They Installed Gas Heat and Lived Comfortably Ever After"

Illustration used by the Iowa City (Ia.) Light & Power Co. in an announcement of their House Heating Campaign

Gas Flood Lighting of York Minster

York Minster Flood Lighted By Gas

Correspondence from H. E. Bloor, Manager The York Gas Company, Davygate, York, describing the installation

Dear Sir:

THE public today, in England, reacts readily to the appeal of modernity, and are very willing to dub things "out-of-date." We enjoyed for so long the position of being the accepted lighting medium, and we are exposed over here, to the accusation that "Gas is out-of-date." Many gas men are only too willing to say "Gas lighting is out-of-date," but our competitors do not leave it there and naturally make the wider statement.

It has seemed to me, therefore, that if in some sphere of lighting, gas could secure the reputation, not merely of being up-to-date, but of being superior to Electricity, it could not but be a valuable score for Gas.

Gas Lighting Installation

It can, I think, be fairly claimed, that so far as the community which this Company serves is concerned, that reputation has been achieved.

You may imagine what gratification it occasioned to me, when the eminent Scientist, who is the Curator of the Yorkshire Philosophical Society, in whose grounds (in addition to their Museum) stand the ancient Roman Tower and the Ruins of St. Mary's Abbey, came to me to ask if my Company would undertake the floodlighting of their grounds, and giving as his reason: "Gas is much superior to Electricity for this purpose."

It is, of course, quite hopeless to attempt to produce the desired result by operations on the small scale, and when it became a question of joining adequately in the Celebrations of H. M. Jubilee, the relatively enormous task of floodlighting York Minster, and the surroundings of the Dean's Park, appeared to the Directors of the Company, to be the only new subject left for gas to conquer here.

York Minster is probably one of the largest individual buildings ever floodlighted, and I enclose a card giving some of the dimensions.

A difficulty which was experienced was, that gas does not lend itself so readily to be projected as does Electric light. Our large lighting units of necessity contain a number of mantles, and it was found necessary to take advantage of the fact that the light from individual mantles can be handled comparatively easily, and to manufacture lamps with individual reflectors. These lamps were for convenience mounted in a frame, and served their purpose admirably.

The centre Tower of the Minster (213 ft. high) was completely enclosed with scaffolding, and was therefore, only sufficiently illuminated to be visible, and so preserve the balance of the building. It would, however, have been quite easy to illuminate this Tower from a distance of 300 ft., with the lamps referred to.

The York Minster forms the Northern Boundary of the Dean's Park, and as the scheme was to illuminate the boundaries of the Dean's Park, it was therefore, the North face of the Minster which was illuminated. It formed a complete enclosed floodlighting scheme, but it was found possible in addition, to illuminate the West End Towers, which greatly widened the area in which the floodlighted Minster was

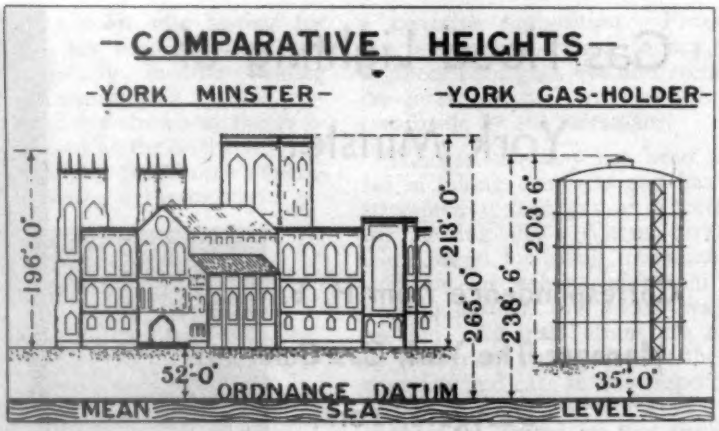
The West Towers were illuminated by means of 6 12-Lt. strip lanterns with reflectors for the lower portions, and 4 8- and 9-Lt. single mantle assemblies.

The Clerestory was lighted by 8 12-Lt. strip lanterns, and 1 10-Lt. lamp mounted on the lower roof, between the flying buttresses, while the walls of the Nave, and the North Transept were lighted by 16 12-Lt. strip lamps, and 1 10-Lt. lamp, and 1 single mantle assembly was used to illuminate the pinnacles of the Tower.

The latter lamp was situated at about 120 ft. from the building, and the remaining lamps about 60 ft.

The Chapter House and Transept were lighted by 8 12-Lt. strip lanterns (48 ft. from the building), and the East Pinnacles by 4 12-Lt. strip lanterns, and 1 10-Lt. projector (120 ft. from the building).

In practice, it was found necessary to carry out numerous experiments in the placing of the lamps, and the adjustment of the reflectors, as many difficulties arise in floodlighting ancient buildings which would not be experienced with a modern structure.



Seeing that your impressions must necessarily be formed from photographs, it is of interest to mention that visibility is not a true guide to actinic properties from the point of view of the photographer, thus the pinnacles of the West Tower were perfectly illuminated to the eye, but not in all cases to the camera. On the other hand, in certain cases the camera gives an excellent result, and I am enclosing photograph to illustrate this point.

H. E. Bloor.

Indiana Conditional Sales Act

NOW that it has just gone into effect, the gas appliance industry in Indiana has discovered with surprise and dismay that the last legislature passed a couple of bills relating to installment purchases. One bill affecting conditional sales contracts is modeled after the Uniform Conditional Sales acts in force in several other states. This is not so important, except that it provides for a lot of things on the part of the seller that have not been common practice in Indiana.

The other bill, however, is one which is new and fixes a $100 license fee for all who add a financing charge over and above the regular rate of interest. The bill ostensibly was introduced to curb some of the activities of regular financing companies, but now it is discovered that it applies to all members of the trade who handle their own paper and add a financing charge. This act is enforced by the newly created department of financial institutions and apparently has caused some comment in other states because the department is getting requests from lawmakers in many other sections for copies of the bill.

The act provides that every installment sale shall include in writing: The cash price of the merchandise; the amount in cash of the down payment, whether made in money or merchandise or both; the unpaid balance of the cash price; the cost of insurance to the retail buyer or the seller; the principal balance owed, being the sum of the unpaid balance and the cost of insurance; the amount of the finance charge; the time balance to include the number of installments and the amount and date of each payment necessary.

In case the seller purchases insurance, he must within 25 days provide the buyer with the policy or a certificate describing the protection, the kind and amount thereof.

Finance charges must not be more than those authorized by the department of financial institutions. No seller may assign or sell his contract to any person other than a licensee under the act.

Applications for licenses shall contain: The name and address of the principal office of applicant and addresses of each branch; the trade name, if any, of the business; whether a co-partnership or corporation, and the name of every partner or of each corporation official or directors; the total authorized investment used or to be used in the business; a statement of the total amount of business done during the last fiscal year.

Every licensee shall report on or before March 15 each year giving information regarding his business. The state department has the right to examine the books and to fix costs for such examinations if deemed necessary.

In addition to having its license revoked, a penalty is fixed which says: "Any person who wilfully violates any of the provisions of this act, or the rules and regulations promulgated by the department under the authority hereof, or any person who wilfully in any report of account filed in pursuance of any provision of this act or rule or regulation of the department makes any untrue statement of a material fact or omits to state any material fact necessary to give the department information lawfully required by it, shall upon conviction be fined not more than $1,000 or imprisoned not more than one year or both."

Under the conditional sales act, which went into effect the same time, installment contracts need not be acknowledged, but the original or a copy must be filed with the county recorder in order to make them valid against third parties. Contracts for equipment which is affixed to realty in such a way as to become part thereof are not binding against the owner of the realty unless he has expressly assented to the reservation of title; nor are they binding against subsequent purchasers of the realty unless the contract, together with a statement signed by the seller briefly describing the realty and stating that the goods are to be

(Continued on page 110)

A New Modification Of The Circular Manifold Type Of Gas Analysis Apparatus

Minor C. K. Jones
Department of Gas Engineering, Johns Hopkins University

THE author's first modification of the Barnhart-Randall gas analysis apparatus (1) has been described in the Gas Chemists' Handbook (2). This apparatus is unique in that it is built around a circular manifold. Further improvement of this aparatus has been made by the incorporation of the Huff pumping pipette (3), designed by Dr. Wilbert J. Huff, Professor of Gas Engineering, Johns Hopkins University. A complete description of the apparatus is presented to make this perfected apparatus available to gas analysts.

Apparatus

The modified gas analysis apparatus is shown in Figure 1. It consists of a central measuring burette, around which are grouped seven pipettes. The apparatus is supported by a substantial wooden stand.

The central measuring burette is about 105 cubic centimeters capacity, graduated in one-tenth cubic centimeters from 50 to 102 cubic centimeters. The bulb at the top of the burette narrows to a capillary tube which joins a nine outlet circular manifold of capillary glass, the manifold being at a right angle to the burette.

One of these manifold outlets is connected to a manometer tube. The manometer inlet has a stopcock and the outlet is connected with the Peterson compensating tube. A water jacket surrounds the Peterson tube and the entire burette. An iron rod with a support carries the leveling bottle for the burette. A stopcock is placed in the rubber hose connecting the leveling bottle with the base of the burette.

One manifold outlet is connected to a stopcock with tip for rubber connections.

One of the manifold outlets is connected to the mercury-filled explosion pipette (Figure 3), which carries a one-way inlet stopcock.

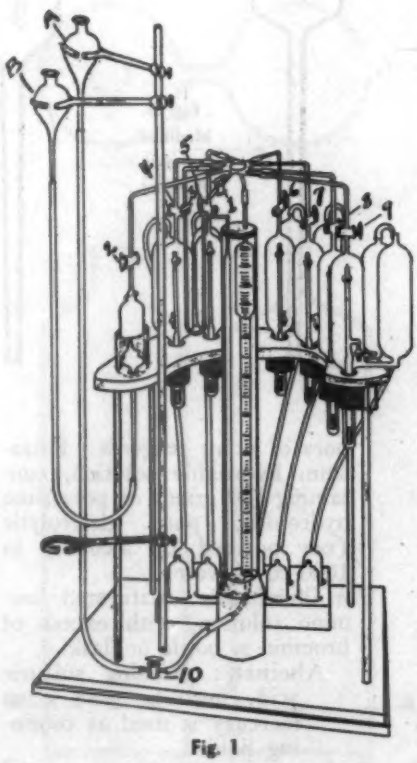


Fig. 1

The bottom of the explosion pipette tapers to a tube, passing into a wooden support. Rubber tubing, carried through the support, connects this tube with the pear-shaped explosion pipette leveling bulb. This bulb is supported by adjustable clamps on an iron rod. Spark is supplied by a suitable coil with convenient switch. When the nature of the gas requires it, a similar pipette with platinum spiral may be used for slow combustion procedures.

The other six manifold connections are connected to the reagent pipettes for absorption of the various constituents which may be present in the particular gas under examination.

Figure 4 shows the standard Barnhart-Randall liquid reagent pipette. This pipette has a two-way stopcock so that by use of the single connection, the gas may be bubbled through the reagent, and by use of the two-pass connection, may be drawn back. It is used for various liquid gas analysis reagents, such as sodium hydroxide solution.

Figure 5 shows the standard Barnhart-Randall solid reagent pipette. This pipette has a one-way stopcock. It is used to hold sticks of phosphorus for the determination of oxygen, when such procedure is desired.

A receiving flask, shown in Figure 6, is used to support these reagent pipettes, and to act as reagent reservoirs.

The Huff pumping pipette which in the new modification replaces these reagent pipettes, is shown in Figure 2. While this is the standard design for the Orsat type gas analysis apparatus, it has the advantage that it is equally applicable to the circular manifold type apparatus upon addition of capillary connection and stopcock. In this pipette a coil periodically energized by a current flowing through a suitable make and break device causes a glass piston containing soft-iron wire to rise and fall in the cylinder at the base of the pipette, pumping the reagent up into the gas filled space, where it is discharged in a spray through several jets. The coils are usually placed on the wooden shelf supporting the pipettes, although they may be supported underneath as shown in Figure 1 for clarity.

The manifold connections are arranged on a horseshoe plan around the central burette, as follows:

1. To stopcock connection in center, in front of measuring burette. Then in clockwise order to:
2. Explosion pipette.
3. Manometer tube.
4. Acid cuprous chloride solution pipette.

5. Ammoniacal cuprous chloride solution pipette.
6. Alkaline pyrogallol pipette.
7. Fuming sulfuric acid or bromine solution pipette.
8. Potassium hydroxide solution pipette for acidic vapors.
9. Potassium hydroxide solution pipette for carbon dioxide removal.

The four pipettes containing reagents which must be kept out of contact with the atmosphere are connected to water filled seal tubes, shown in Figures 7 and 8.

The apparatus is easily operated, rapid, accurate, of sturdy construction and economical of reagents.

Reagents

The following solutions and reagents are used:

Confining liquid:
Burette: Mercury, or water colored with methyl orange, acidulated with sulfuric acid and saturated with gas.
Seal tubes: Water.
Reagents:
For carbon dioxide and acidic vapors of other reagents: Potassium hydroxide solution, containing 500 grams of potassium hydroxide, pure electrolytic (not purified by alcohol) in 1000 cc of water.
For illuminants: Saturated bromine solution, with excess of bromine in bottle or flask.
Alternate: Fuming sulfuric acid (must be used when mercury is used as confining liquid.
For oxygen: Alkaline pyrogallol solution containing 50 grams pyrogallic acid to 1000 cc of above potassium hydroxide solution.
For carbon monoxide: Ammoniacal cuprous chloride solution, containing 200 grams cuprous chloride in 2000 cc concentrated ammonium hydroxide solution.
Acid cuprous chloride solution, containing 200 grams cuprous chloride in 1000 cc of concentrated hydrochloric acid and 1000 cc of water.

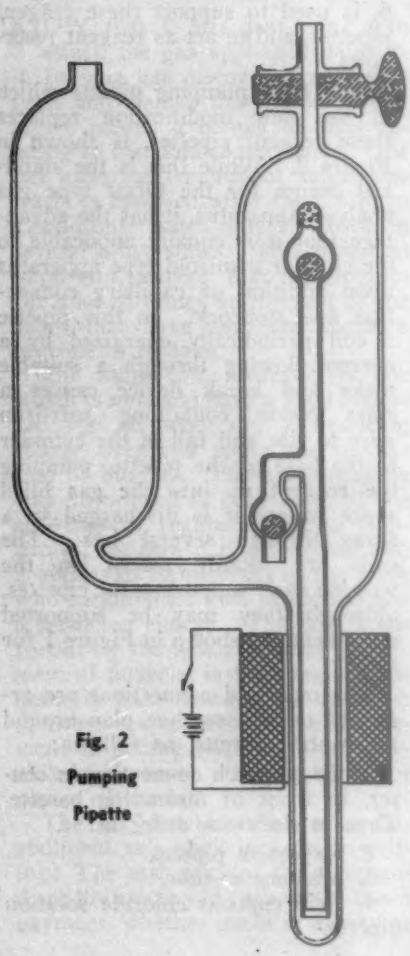


Fig. 2 Pumping Pipette

Fig. 3 Modified Explosion Pipette

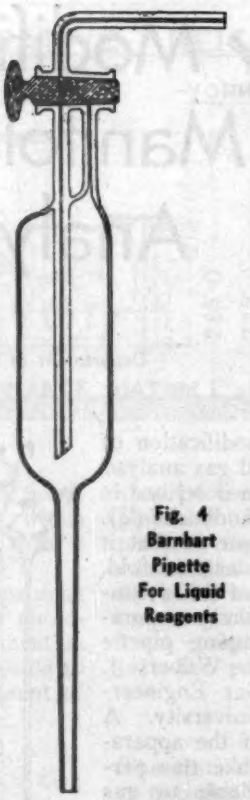


Fig. 4 Barnhart Pipette For Liquid Reagents

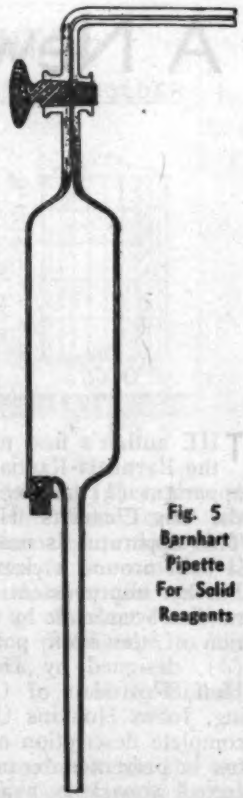


Fig. 5 Barnhart Pipette For Solid Reagents

Operating Procedure

General:
The burette water jacket is completely filled with water.
The manometer on the compensator is filled with water or mercury, depending on which fluid is used in the burette. In routine procedure water is a satisfactory confining liquid. In precision gas analysis mercury is used as the confining liquid. With mercury no time is lost in waiting for drainage and the gas can be transferred more rapidly. However, greater care is necessary in maintaining tight connections and stopcocks. A little water should be kept above the mercury in order that the gas may be saturated with water vapor. There is hardly any advantage in using the compensator tube when water is used as the confining liquid, unless temperature changes are great. When water is used as the confining liquid, one minute as time for drainage is allowed before each burette reading. This time may be conveniently measured by a sand glass attached to the apparatus. In the following outline of procedure, it is understood that before each reading of gas volume, the compensator is to be used, with mercury; or that the drainage time and leveling bottle will be used, with water.
The pipettes are filled with their respective reagents up to the circular capillary manifold, by lowering the leveling bottle A, Figure 1 (while stopcock 1 is closed), and opening in turn stopcocks 2, 4, 5, 6, 7, 8 and 9. Bulb B controls the mercury level in the explosion pipette.
The burette is then filled by rais-

ing the leveling bottle A with stopcock 1 open, until the liquid expells all gases through stopcock 1.

Fig. 6
Barnhart Pipette Receiving Flask

Measuring the Sample:

The source of the gas sample is connected to stopcock 1 by rubber hose purged with the gas being sampled. Bottle A is lowered, stopcock 1 is opened, and about 102 cubic centimeters of gas introduced, after which stopcock 1 is closed. Bottle A is raised until 100 cubic centimeters of sample is accurately measured off, when stopcock 10 is closed. By opening stopcock 1 to the atmosphere momentarily the sample is placed under atmospheric pressure. Stopcock 10 is opened and the volume checked by balancing the leveling bottle.

Analysis:

By raising bottle A and opening stopcock 9, the gas is passed into the first potassium hydroxide pipette. Stopcock 9 is closed and the pipette pump is placed in operation. Experience indicates the exact time necessary for the pump to remain in operation, this time depending upon the nature of both the gas and the reagent in question. After absorption is complete, the pump is turned off. Lowering bottle A, stopcock 9 is opened, the sample returned to the central burette, and stopcock 9 is closed. The burette volume is read. The difference between this reading and 100 equals the percentage of carbon dioxide in the gas.

The gas is then passed, in a similar manner, into the fuming sulfuric acid or bromine pipette, through stopcock 7 for an absorption period with the pump operating; then it is returned to the burette and next passed through stopcock 8 to the second potassium hydroxide pipette to remove vapors. The gas is returned to the central burette and the volume read. The difference between this reading and that after removal of carbon dioxide is the percentage of illuminants.

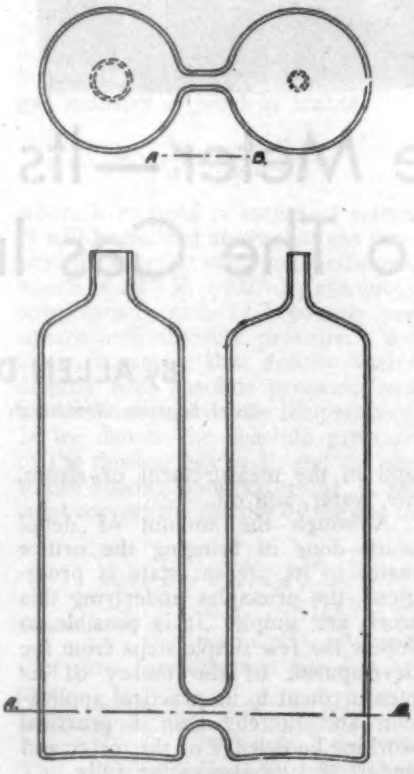


Fig. 7
Reagent Seal

The action of potassium hydroxide solution is very rapid. Where there are no simultaneous duties, and time is not a vital factor, the standard Barnhart-Randall liquid reagent pipette may be satisfactorily used for the absorption of carbon dioxide and acid and bromine vapors, instead of the pumping pipette.

The gas is then passed into the alkaline pyrogallol pipette through stopcock 6, and the pump actuated until oxygen is removed. The pumping pipette is extremely valuable in this absorption. The sample is drawn back into the burette and the volume read. The difference between this and the preceding reading gives the percentage of oxygen.

The gas is then passed through stopcock 5 into the ammoniacal cuprous chloride pipette for absorption of carbon monoxide with the pump operating; returned to the burette and passed to the acid cuprous chloride pipette through stopcock 4 to remove ammonia fumes and for the further removal of carbon monoxide with the pump operating; returned to the burette and finally passed to the second potassium hydroxide pipette through stopcock 8 to remove acid fumes with the pump operating; returned to the burette and the volume read. The difference between this reading and that after oxygen is the percentage of carbon monoxide.

The absorbable constituents having been removed at this point, the rest of the analysis is completed by explosion. About 15 cc of gas is passed into the explosion pipette, by lowering bulb B, raising bottle A, and opening stopcock 2. This stopcock is closed when about 15 cc of gas has been passed; an accurate burette reading is then made, indicating exactly how much gas has been placed in the explosion pipette. The residue of the sample is placed in the second potassium hydroxide pipette for storage as a reserve sample.

When water is used as a confining liquid, the water in the measuring burette is replaced with fresh water at this point. Eighty-five cc of air is accurately measured, and added to the gas sample in the explosion pipette. After adjusting bulb B to a lower position the air-gas mixture is exploded by sparking through the terminals. A wire mesh is usually placed around the explosion pipette to avoid hazard from glass in case of an accidental rupture of the explosion pipette. The gas after explosion is drawn back into the burette and its volume noted. The

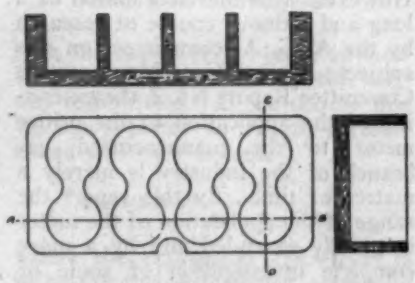


Fig. 8
Support for Reagent Seal

difference between this volume and the volume before explosion is the contraction. Various air-gas mix-

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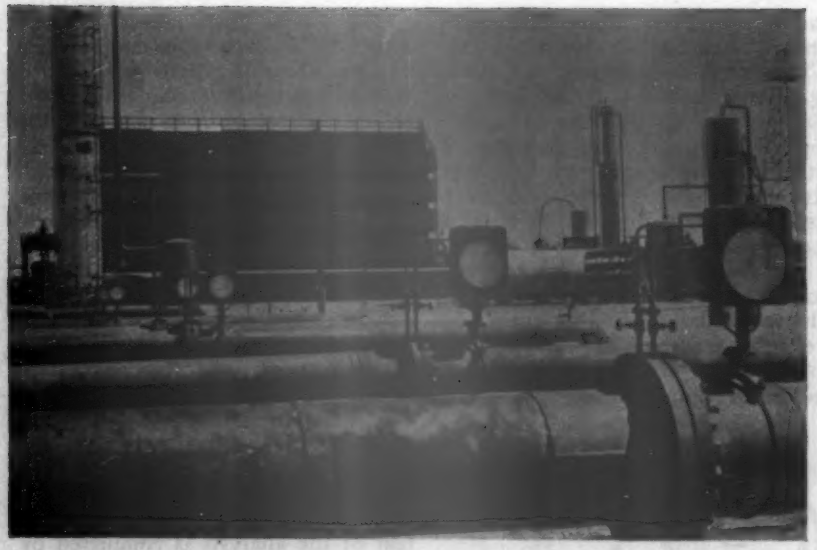


Typical Orifice Meter Installation

The Orifice Meter—Its Increased Value To The Gas Industry

By ALLEN D. MacLEAN
Chief Engineer, Pittsburgh Equitable Meter Company

ONE of the most interesting developments in all gas measurement is the use of the orifice type meter for the measurement of gas flow. In external form the measuring element of an orifice meter installation is "just a hole to push gas through," but the amount of thought, research work, and investigation which has been expended in making the "pushing of gas through this hole" a true scientific and accurate procedure is appalling. The result is a widely-used, accurate, flexible and suitable measuring device.

In the gas industry the orifice meter has grown up in the natural gas branch, where large volumes and higher pressures have made some sort of a measuring device other than the diaphragm meter a necessity. However, with the culmination of a long and arduous course of research by the A. G. A. committees on this subject in the Gas Measurement Committee Report No. 2, the extending of the application of the orifice meter to the manufactured gas branch of the industry is merely a matter of time. By this report the range of the application of the meter is greatly extended and by a more complete investigation of some of the factors involved, minor inaccuracies have been eliminated. The inevitable result is an increased field of application for this very excellent measuring device in the manufactured gas industry, as has been experienced in the natural gas industry, and in the measurement of steam, air, water, and oil.

Although the amount of detail work done in bringing the orifice meter to its present state is prodigious, the principles underlying this work are simple. It is possible to follow the few simple steps from the development of the theory of its measurement to its practical application and thereby gain a practical working knowledge of the meter and understand its application fully.

The start is elemental. Going back to the laws of a falling body, by comparing the kinetic energy possessed by a particle by virtue of having fallen through a given distance, with the potential energy possessed by the fluid caused by the weight of the fluid above it, the fundamental relation of the orifice meter is obtained.

When a body falls freely to the earth without resistance, its velocity is equal to the product of the square root of the height from which it has fallen, and 2g, in which g is a factor called the gravitational acceleration, and for a given locality is constant.

This formula is $V = \sqrt{2gH}$

V is velocity in feet per second

H is height in feet

g is gravitational acceleration = 32.2 feet per second.

At any given point in its falling path, the freely falling body possesses a certain amount of energy by virtue of its velocity, which is called kinetic or moving energy. It so happens that the potential energy (i.e., energy due to its position) of a liquid in a tank at a given distance below its top level, is equal to the kinetic energy which that liquid would have if it had fallen this same distance. If we were to make a hole in the tank at this distance below the top surface, the velocity of the liquid emerging through this hole would depend on its potential energy. Now since this potential energy just equals the kinetic energy the liquid would have in falling thus far, the velocity of emergence caused by the potential energy is the same as the velocity which the liquid would have in falling this same distance. In this manner is derived the formula for flows in fluids, and it is sometimes called the hydraulic formula. The distance H as in Fig. 1, in a liquid of known weight, causes a certain pressure at the hole which is entirely expended in getting the liquid through the hole to the atmospheric pressure outside, so in reality H is a measure of the loss of pressure in flowing through the orifice. As we know, in orifice meter measurement H is loss of pressure

in going through the orifice, usually expressed in inches of water head.

This fundamental equation $V = \sqrt{2gH}$, which tells us how velocity through an orifice and pressure loss across the orifice are related to each other, is transformed and changed before it can be used in actual gas measurement, almost to a point where it is barely recognizable, yet it is the same fundamental equation.

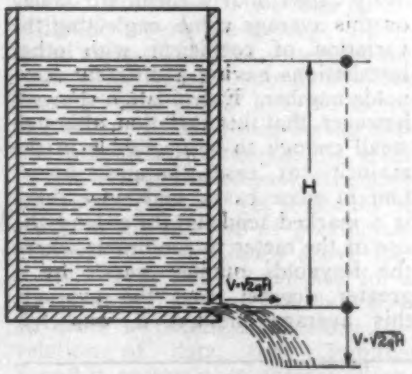


Fig. 1. Derivation of Orifice Meter Formula from Law of falling bodies.

In transforming the velocity value V into volume sales, we must know the size of the hole through which the gas is flowing. The area of the orifice in square feet is $\frac{\pi d^2}{4 \times 144}$, where d is the diameter of the orifice in inches. When this expression is multiplied by the velocity V, feet per second become cubic feet per second, and, since there are 3600 seconds in an hour, multiplying by 3600 will give us cubic feet per hour.

Our formula now is

$$Q = \frac{d^2}{4 \times 144} \times 3600 \sqrt{2gH} \text{ or}$$
$$Q = 19.64 d^2 \sqrt{2gH}$$

where Q = rate of flow in cubic feet per hour.

In our fundamental formula, H is expressed in feet head of the liquid flowing. Since we are measuring gas, H should be expressed in head of gas of a homogeneous density, exactly that density which the gas has at the orifice. We must realize here that since a liquid is not compressible, it is homogeneous from the orifice up to its top level, whereas a gas being compressible, would decrease in density as we went upward from the orifice to the top level. Our fundamental conception assumes a gas which is homogeneous, and has the density of the gas at the orifice. Since this assumption does not affect the flow it is permissible.

In orifice meter work, however, we express the head not in feet of gas, but in equivalent inches of water; so we must, by using the density of the gas as compared to water, transform the gas head expressed in feet into water head expressed in inches. The weight of the gas per cubic foot equals the weight of a cubic foot of air times the specific gravity of the gas at standard conditions. The weight of a cubic foot of air at 32° F. and 14.7 pounds per square inch absolute pressure is .08073 pounds per cubic foot, so the weight of a cubic foot of the gas under the same conditions is .08073 G where G = the specific gravity of the gas relative to air. The weight of the water = 62.37 pounds per cubic foot. H it will be noticed is expressed as head in feet, but what is more convenient in the gas industry is head in inches.

$$H = \frac{h}{12} \times \frac{62.37}{.08073 \times G}$$

where h = head in inches of water. It will be noticed above that gas density was taken at standard conditions, which is 32° F. (492° F. absolute) temperature, and 14.7 pounds per square inch absolute pressure. We know, however, that density varies directly with absolute pressure, and inversely with absolute temperature. If we denote the absolute pressure of the flowing gas as P, and the absolute flowing temperature as T, we must correct the density of the gas to

$$.08073 \times G \times \frac{P}{14.7} \times \frac{492}{T}$$

$$\text{Then } H = \frac{h}{12} \times \frac{62.37}{.08073 \times G} \times \frac{14.7}{P} \times \frac{T}{492}$$

Our flow formula then becomes

$$Q = \sqrt{19.64 d^4 \sqrt{2g} \times \frac{h}{12} \times \frac{62.37}{.08073 \times G} \times \frac{14.7}{P} \times \frac{T}{493}}$$

The value g is equal to 32.16, so that in rewriting our formula and combining constants we obtain

$$Q = 218.44 d^2 \sqrt{\frac{h\,T}{P\,G}}$$

This it will be noticed is cubic feet of gas of specific gravity G at absolute pressure P, and absolute temperature T. Usually in gas work, when we speak of cubic feet of gas, we must specify at what pressure base and temperature base we wish to reduce the volume.

The above value of Q must be so corrected, so let us assume that we want gas volume expressed at a pressure base P_B and temperature base T_B. Since according to Boyle's law, volume varies inversely as the absolute pressure, and according to Charles' law volume varies directly as the absolute temperature, the volume corrected to base becomes

$$Q_c = Q \times \frac{P}{P_V} \times \frac{T_B}{T}$$

where Q_c = volume corrected to desired bases.

The formula, thus providing for correction is

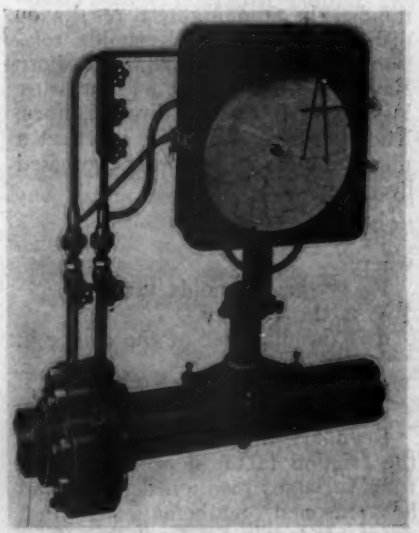
$$Q_c = 218.44 d^2 \frac{P}{P_B} \frac{T_B}{T} \sqrt{\frac{h\,T}{P\,G}}$$

which we call the fundamental orifice meter formula.

In our first step we have merely taken the simple relation of velocity observed from the law of a falling body, applied this relation to orifice meter measurement, and by using mathematical values, arrived at a formula showing the relation of flow to differential pressure across the orifice plate. As is the case with practically all physical laws there must be some practical modifications made and on making tests it will be observed that due to certain frictions and inefficiencies in flowing fluids, the above law must be modified by the use of a coefficient; and it is the derivation of the coefficient to be used with flat slate orifices that has been the basis for the large amount of research work done by the various committees. If we denote this efficiency factor as K the formula above will then become

$$Q = 218.44 K d^2 \frac{P}{P_B} \frac{T_B}{T} \sqrt{\frac{h\,T}{P\,G}}$$

where the expression $218.44 K d^2$ is in reality the basic factor appearing in the published coefficient tables.(1) It will be observed in comparing actual tests results with the formula that K is a variable depending upon



External View of Orifice Meter.

(1) Gas Measurement Committee Report No. 2—and Appendix—obtainable from the American Gas Association, 420 Lexington Ave., New York, N. Y.

the orifice size, the pipe size, the rate of flow, the density of the gas, the viscosity of gas, the ratio of the differential to the upstream pressure and the ratio of specific heats of the gas. At first sight, since this factor K varies with so many variables, it would seem almost a hopeless task to arrive at a satisfactory evaluation. In the earlier tables of coefficients for the orifice meter, the effects of density, viscosity, velocity and volume on this coefficient were neglected and the tables were published showing the value of K as against orifice diameter and pipe diameter only.(2) The error in the coefficient occasioned by neglecting these factors was not of large magnitude in most cases. However, it was an error and the work of the committee both in actually running tests and in mathematical computation has eliminated the uncertainties caused by neglecting the effect of these various factors on K.

The greatest forward step in taking into account the effect of velocity, density and viscosity on K was the introduction of the Reynolds number in studying test results on orifice meters. The Reynolds relation was observed in 1883 by Osborn Reynolds in connection with pressure loss of fluids flowing through pipes. The Reynolds number is in effect a dimensionless value and is expressed by the formula

$$R_d = \frac{V d \rho}{\mu}$$

where

R_d is the Reynolds number,
V is the velocity
d is the diameter of the orifice in feet.
ρ is the density of the gas
μ is the absolute viscosity.

Reynolds, in his work, noted that the friction factor depended on the four variables mentioned above and he reasoned mathematically that since this factor did depend on these four variables, their grouping in the formula showing their interdependence would have to be such that the dimensions would cancel out. This mathematical reasoning was proved by actual test work and Reynolds was able to show that friction factor of a flowing fluid, whether the fluid is flowing through pipes or through an orifice or through a venturi or any device which causes friction, is a dimensionless factor depending upon these four variables. If we substitute for the variables in the above formula we will see that the dimensions do cancel out and we have a dimensionless factor.

If we denote mass by M, length by L and time by T, the dimensional expression for velocity is $\frac{L}{T}$, the dimensional expression of the diameter is L, the dimensional expression of density is $\frac{M}{L^3}$, the dimensional expression of viscosity is $\frac{M}{LT}$. The dimensional expression of the Reynolds number then will be

$$\frac{\frac{L}{T} \times L \times \frac{M}{L3}}{\frac{M}{LT}} = 1$$

which, it will be noted, reduces to 1. It is found in correlating data on flow through flat orifice plates that if the Reynolds number is the same for any given measurement condition as that for another, the coefficient is the same, no matter how the variables V, d, ρ, and μ vary. The fluid can be a liquid or a gas, the viscosity and density can vary over wide limits, yet, if the Reynolds number relation is the same for a given number of instances, the coefficient K is the same. The recognition of this important fact permitted the correlation of data obtained from a wide number of sources. Not only did the actual work done by the committee plot very much more accurately when considered from the standpoint of the Reynolds number, but work done on oil, water, gas, steam, and air by other investigators could be correlated and the coefficients found to fall along a logical curve. The use of the Reynolds number permitted the checking of a number of the orifices used by the committee against water flow and since the water volume can be very easily measured by weighing, a good primary standard was therefore available.

Recognizing that the factor "K" is influenced by the Reynolds number, the committee was faced with the practical problem of making the use of the Reynolds number available to the gas industry. It would be possible, for instance, to choose a Reynolds number value which would appear to be the average of a large number of installations, and base the basic factor table (previously called hourly coefficient table) on this average value, neglecting the variation of coefficient with other installations having a different Reynolds number. Examination showed, however, that this variation, although small enough to be negligible in the majority of cases, became important in some cases, and since there is a marked tendency to extend the use of the meter to conditions where the Reynolds number varies by a greater degree from the average, this average method it was felt would permit in many instances, too great an error.

The more logical arrangement arrived at is to publish factors based on a Reynolds number of infinite value.(3) (Plotting observed coefficient versus a function of the Reynolds number for each size pipe made the coefficient determination at infinite Reynolds number a simple matter). For each individual installation of orifice meters, this basic coefficient must be modified so as to give a coefficient for the actual Reynolds number of the installation. Since the velocity varies as h the differential pressure, and the density varies as the flowing pressure P, and since for most gas work the viscosity can be considered as constant (for natural gas = .0000069), it is only necessary to obtain from calculated tables (published in the previously mentioned report) a factor deby which to multiply the basic coefficient. The h and P selected are the expected average of the installation. The actual correction factor may be small and in a great many

$$K = \left(0.5993 + \frac{0.007}{D} + \left(0.364 + \frac{0.076}{\sqrt{D}}\right)\beta^4 + 0.4\left(16 - \frac{1}{D}\right)^6\left[\left(0.07 + \frac{0.5}{D}\right) - \beta\right]^{\frac{5}{4}}\right.$$

$$\left. - \left(0.009 + \frac{0.034}{D}\right)(0.5 - \beta)^{\frac{3}{2}} + \left(\frac{65}{D^2} + 3\right)(\beta - 0.7)^{\frac{5}{2}}\right\}\left\{\frac{1}{1 + \frac{12\left[d\left(830 - 5000\beta + 9000\beta^2 - 4200\beta^3 + \frac{530}{D^2}\right)\right]}{1{,}000{,}000\,d}}\right\}$$

Fig. 2. Formula for Computing Basic Factor for Flange Connected Orifice Meter

(2) As a matter of historical interest, the previous formulae used for evaluating K are given here.

For flange taps—

$$K = .606 + 1.25\frac{d}{D} - .41\left(\frac{d}{D}\right)^2$$

For pipe taps—

$$K = .58925 + .2725\frac{d}{D} - .825\left(\frac{d}{D}\right)^2 + 1.75\left(\frac{d}{D}\right)^3$$

(3) For the mathematically inclined, the formula for the basic factor at infinite Reynolds number is shown in Figure II.

cases appear to be negligible. However, since it is always in a constant direction, that is, always greater than 1, it is an error which will accumulate unless corrected for. As an example of its magnitude, let us assume a meter installation in which the average differential pressure is 50″ of water and the average absolute static pressure is 50 pounds. By referring to tables in the committee report, we see that for 3″ plate in a 6″ line the correction factor is 1.0007. However, if we take an installation where the average differential pressure is 2″ of water and the static pressure is 15 pounds absolute for a 1″ plate in a 6″ line, the factor is 1.0105. As can be seen during normal measurement ranges, the error by neglecting the Reynolds number correction is small, yet it should be made in the interest of greater accuracy. It is mentioned above that a basic coefficient is published for a Reynolds number of infinite value. In order to obtain satisfactory correlation of data, the committee found it necessary to correct all observed data back to this basis. If the Reynolds number correction had not been made, the data gave rather spotty results and would not have anywhere near the continuity of the present basic factors.

The variation of the coefficient K with pipe diameter and orifice diameter is taken care of in the table by the fact that for each pipe size and for each orifice size the basic factor is shown. This leaves the expansion factor as the only serious factor affecting K. A correction for expansion factor is made necessary because of the fact that the density of the gas itself changes as it passes through the region of the orifice in a pipe line. If we have gas at close to atmospheric pressure and we have a pressure loss of, let us say, 50″ of water in passing through the orifice, it will be seen that this reduction in pressure becomes a fairly large percentage of the total pressure and, therefore, since density varies directly as the absolute pressure, we have a large percentage of density variation. A study of this variation in density was made by Mr. Howard S. Bean of the Bureau of Standards and the A.G.A. Committee, based on some previous work by Dr. Buckingham of the Bureau of Standards and a formula derived showing the correction factor necessary for the expansion of the gas. The actual value of this expansion factor is given by the expression

$$Y_1 = 1 - (0.41 + 0.35\beta^4)\frac{x}{k}$$

where

Y_1 = expansion factor

β = ratio of orifice diameter to pipe diameter $= \frac{d}{D}$

x = ratio of differential pressure to absolute static pressure $= \frac{h}{p}$

k = ratio of specific heat at constant pressure to the specific heat at constant volume.

In the actual application of this expansion factor it is necesary to multiply the basic factor by an expansion factor correction. Tables of these corrections are included in the A.G.A. Committee report. By examining the formula we see that the two important variables are x and β if we assume that the value of k for gases to be 1.30. To determine x we merely take the average expected differential pressure and divide by the absolute expected static pressure. The vertical columns are arranged in the table for various values of x. The horizontal columns are arranged for various $\frac{d}{D}$ or β ratios. Thus for any particular installation the value of the expansion factor is determined and then multiplied into the basic factor. For instance, if we have an installation using a flange connected meter in which the static pressure is normally measured from the downstream side and we have an average differential pressure of 20″ of water and an average absolute static pressure of 20 pounds per square inch, the x ratio = 1. If our $\frac{d}{D}$ ratio is .62, the magnitude of the expansion factor is 1.0055, and must be multiplied into the basic factor. As the ratio x increases and the ratio $\frac{d}{D}$ decreases, this factor becomes very important. If, for instance, we have a diameter ratio of .3 and a $\frac{h}{P}$ ratio of 3.6, the expansion factor correction is 1.0278, which is quite appreciable.

It will be seen that under the new system instead of publishing a factor for K against pipe diameter and orifice diameter and using this same K throughout the range of the meter, it is now necessary to modify the coefficient K to take care of variation in Reynolds number and variation in expansion factor. This merely means that the coefficient we now select in a given installation is more nearly accurate than those we previously used. The actual change in coefficient is not very great. As pointed out above, this change always occurs in a constant direction and unless corrected for will give an accumulative error. Corrections for flowing temperature, temperature base, specific gravity and supercompressibility are made as was done previously with the old method. The new committee report contains tables showing correction factors for these variables. However, although they are applied to the coefficient, they are in reality changes shown in the expression of the general flow formula.

The practical meaning of the development of this newer method of coefficient determination is that—first, the coefficients are more nearly accurate than ever before, they have been derived from a much larger range of data, and can be checked (through the medium of the Reynolds number) against similar coefficient tables for air, steam, water, and oil; and, second, the range of measurement has been extended. It is permissible now to use $\frac{d}{D}$ ratio higher than the .60 previously used, and larger differential pressure to absolute static pressure ratio can be used, by making use of the expansion factor correction.

One of the important phases of the committee work has to do with the actual physical dimensions and characteristics of the orifice installation. Plate thickness, flange form, straightening vane design and location, are physical factors which we have long recognized as affecting the accuracy of orifice meter measurement. The magnitude of error caused by variations in these physical factors has been determined, and now it is possible to design an installation, from very clear and concise data published in the committee report, giving assurance that errors are eliminated and insuring accuracy of measurement. In fact, the designer of a meter installation has only to refer to the committee report and his installation is designed.

Referring to our general flow formula, it will be seen that the variables which vary continually and must be recorded in order to compute total flow are the differential pressure (loss across the plate) and the static pressure. The *instrument* we know as the orifice meter is a device for making the record of these

two variables on a clock-driven chart.

The recording of static pressure on the chart is accomplished by means of the well-known pressure coil, used in ordinary pressure recording gauges. The accuracy of these coils is probably one point in orifice meter measurement which will stand the greatest improvement. The general accuracy of static pressure coils is not as close as the accuracy of the differential measuring manometer of an orifice meter, and not as close as the computation of static pressure. Dampening screws, overranging valves, adjustments, etc., are included in the meter.

Since the chart is clock-driven, the accuracy of the clock is important, for if a chart actually is in service 24 hours, yet the record shows 23 hours and 45 minutes, the error is actually 1%. Synchronous electric clocks should be used wherever possible; if spring wound clocks are used, they should be checked often enough to be sure they are accurate.

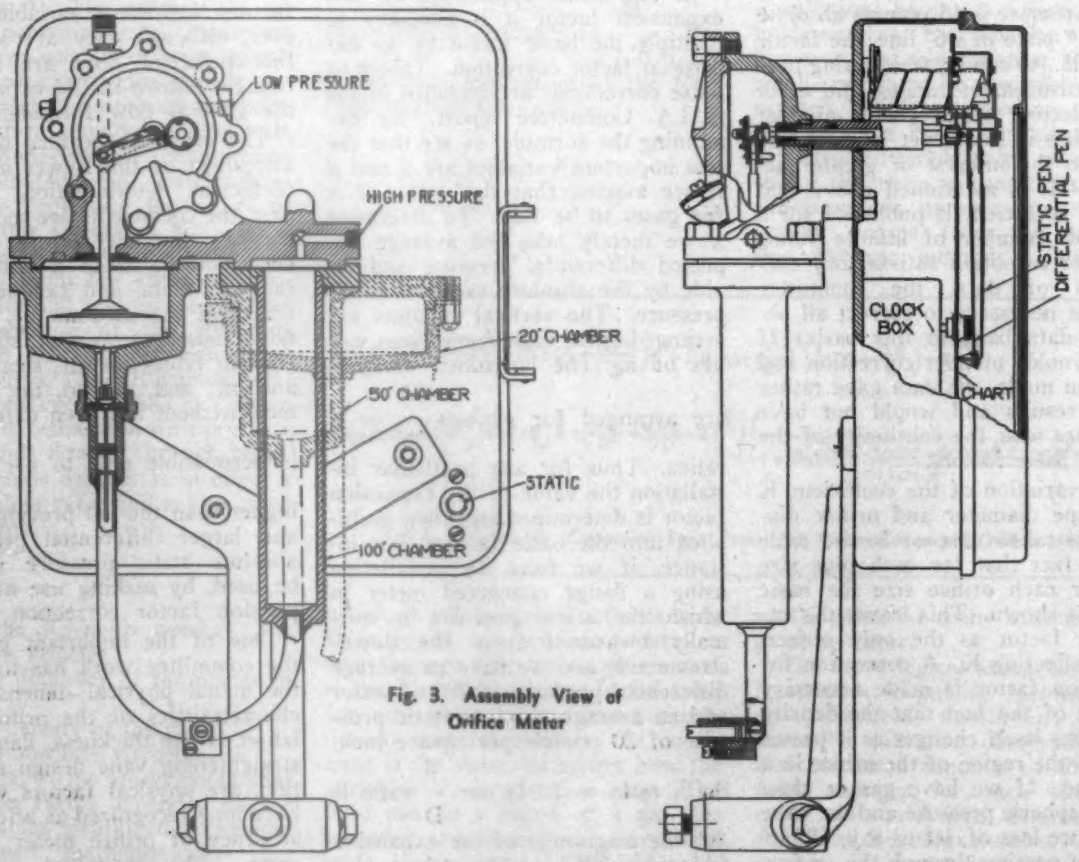


Fig. 3. Assembly View of Orifice Meter

the coefficient. However, the use of high grade pressure coils at this point, and normal checking for accuracy of pressure measurement will keep this variable within the limits of commercial accuracy. Fig. III shows a typical orifice meter and its static pressure coil.

Differential pressure measurement, although expressed in inches of water head (convenient in testing manometer accuracy) is actually measured by using mercury as a manometer fluid. The maximum differential used is 100 inches of water column, and meters are normally made also for 50, 20, 10 and 5 inches. A simple float and lever mechanism records the differential pressure on the same chart as the

The final formula used in most measurement will be

$$Q = C' \sqrt{h P_a}$$

where

- Q = rate of flow (cubic ft. per hour)
- C' = hourly coefficient
- h = differential presure for any given hour (inches of water)
- P_a = absolute static pressure for any given hour (pounds per square inch)

The calculation of C′ we have described briefly above; it is in reality derived from the following formula.

$$C' = F_b \times F_R \times Y \times F_{pb} \times F_{tb} \times F_g \times F_{pv}$$

where

F_b is the basic orifice flow factor published in the committee report.

F_R is the Reynolds number correction factor obtained from a table published in the report. Knowing the pipe size, the *average differential* and the *average absolute static pressure* we can determine $\sqrt{h P_a}$ average and thus determine F_R.

Y is the expansion factor which is also determined from a table included in the committee report. $\frac{h}{P_a}$ for the average condition, and $\frac{d}{D}$ are factors required in selecting the Y factor from the table.

F_{pb} is the pressure base factor (a pure Boyles Law correction)

F_{tb} is the temperature base factor (a pure Charles Law correction)

F_g a gravity correction (the basic factor is for air, (G=1)

F_{pv}=a supercompressibility factor, allowing for the deviation of gases from Boyles Law.

It will be noted that in general C can be determined once and for all for any given installation, and unless some large change in load or pressure occurs, can be left unchanged.

(Continued on page 110)

Review Of Higher Court Cases Involving Gas Right Grants

By Leo T. Parker
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IN a great majority of litigations involving municipal gas right grants, and franchises, the power and authority of the Public Utilities Commission is questioned.

Therefore, it is important to know the various Courts have held that a municipal corporation is a political subdivision of the state, created as an agency expressly for exercising such governmental power of the state as may be entrusted or delegated to it.

On the other hand, it is important to know that neither a municipality's charter, nor state laws which (1) confer governmental powers, (2) or vest in a municipality real property to be used for governmental purposes, (3) or authorize a municipality to manage property, (4) or exempt a municipality from taxation upon the property constitutes a proper and enforceable contract with the state within the limits and meaning of the Federal Constitution.

For example, in City of Pawhuska V. Pawhuska Oil and Gas Co., 250 U. S. 395, it was disclosed that a city granted a franchise to a gas company to use the streets and supply gas to the city and its inhabitants. At this time the city alone had authority to regulate the charges and service to be rendered thereunder.

Later the State Legislature enacted a new law giving this right to the Public Utilities Commission which granted a request of the gas company to increase its rates.

The city contended that this new law was void because it took power from it and unlawfully delegated the same to the Public Utilities Commission. However, the Court held the law valid, saying:

"The municipality, being a mere agent of the state, stands in its governmental or public character in *no* contract relation with its sovereign, at whose pleasure its charter may be amended, changed or revoked, without the impairment of any constitutional obligation, while with respect to its private or proprietary rights and interests it may be entitled to the constitutional protection."

Various Courts have held that a contract is void which is made with representatives of a corporation before it is organized. For example, it has been held that an agreement to purchase stock in a corporation intended to be organized is not enforceable. However, it is interesting to know that this rule is not applicable to a city ordinance which grants a franchise to a gas company which *is intended* to be organized.

For example, in the recent case of Citizens V. Twin City, 10 S. W. (2d) 494, it was shown that a city ordinance was passed which granted the right to a gas company, intended to be organized, to lay pipes in the city streets. Before the corporation was organized the city council enacted another ordinance granting to a competitor gas company the right to construct, lay, and own a gas line from the city limits to large industrial company's plant to supply it with gas.

After the gas company was organized suit was filed contending that the first ordinance was invalid because it granted a franchise to a company not in existence when the ordinance had been passed.

The lower Court held the first ordinance void, but the higher Court reversed this verdict saying:

"It may be said that, even if the corporation was not organized before the passage of the ordinance, the permission had been applied for by those who represented it in petitioning the city council, and it was accepted by these individuals . . . and the corporation was legally organized *before* the expiration of the time granted for acceptance of its terms by the ordinance and the same persons who accepted the ordinance were elected president and secretary of the corporation."

Latest Law Effective

In all cases involving contradicting laws, the most recent law is held enforceable, unless an intention is expressed by the Legislature that when possible the oldest law shall be effective.

For illustration, in City Gas Co., 271 Pac. 270, it was disclosed that a state statute provides that a franchise shall not be granted by a municipality until notice of the intention to grant the franchise has been advertised for twenty days in a newspaper of general circulation. Another older law of the state provides that an intended grant of a franchise shall be advertised for twenty-one days.

A franchise was granted to a gas company after it had been advertised for only twenty days. Litigation developed over the validity of the franchise. It was contended that the ordinance granting the franchise was void because it had not been advertised for twenty-one consecutive days, as required by the older statute.

However, the Court held the franchise valid, saying:

"It is urged that the ordinance is invalid because it was not published for three consecutive weeks. . . . However, that section (law) is *not* applicable."

Long Term Franchise Void

Another interesting phase of the established law is that any ordinance is void which grants a franchise in violation to a state law, or provision of the State Constitution.

For example, in Memphis, 4 S. W. 614, it was shown that a clause in a state constitution prohibits monopolies. A city granted an exclusive franchise to use the city streets and alleys for constructing, maintaining, and operating mains for 25 years at a fixed rate of charge to consumers.

The Court held the franchise void, and said:

"The fact that one paragraph in a franchise of this character violates that part of Article 1, P. 26, of the State Constitution, prohibiting the creation of a monopoly, has the effect of rendering the entire contract void, because it cannot be said how much of the obligation is based upon the illegal consideration."

When Is Franchise Exclusive?

Generally speaking, a gas company franchise is not exclusive unless the city ordinance or contract which grants the franchise, clearly and unmistakably specifies that such franchise is exclusive. So held a higher Court in the leading case of Dorado V. Coats, 299 S. W. 355.

In this case it was shown that a gas company held a twenty year franchise to supply gas to the consumers in a city. Although the franchise did not specify that the gas company held the exclusive franchise to supply gas to consumers within the city, yet the ordinance required the gas company to pay 2% of the gross receipts to the city, and the gas company was obligated to furnish gas free to the city for its public buildings.

A few years later the city council passed another ordinance granting a franchise to another gas company to supply gas to the inhabitants of the city.

The first gas company filed suit to invalidate the second franchise on the grounds that it had the "exclusive" right to supply gas to the inhabitants of the city because, while the franchise did not expressly grant the exclusive right, yet an exclusive franchise was implied which required the gas company to pay 2% of the gross receipts to the city and to furnish free gas to public buildings.

However, it is important to know that the word "exclusive" was not in the ordinance, and the Court held the franchise to the competitive company valid. This Court said:

"In this country, as in England, every grant from the sovereign power is to be construed strictly against the grantee, and in favor of the city or government. The rights of the public are therefore not to be presumed to have been surrendered to a corporation, except so far as the intention to surrender them appears in the charter. . . . A state or council ought never to be presumed to surrender this power, because the whole community have an interest in preserving it undiminished. . . . If no exclusive right was conferred, then the second ordinance, which granted the franchise of the same rights to the appellant company, is valid, because no obligation of contract was impaired."

Contract Held Valid

Considerable discussion has arisen from time to time whether a contract is valid and enforceable by the terms of which a gas company agrees to pay a specified per cent of its income to the municipality that grants a franchise permitting use of its streets in which to lay gas mains.

Generally speaking, the relationship with reference to a franchise, and its provisions for a gross receipts tax is contractual and is to be distinguished from cases of purely revenue producing ordinances calling for license or occupational taxes.

In other words, when a municipal corporation has the power to grant or refuse in its discretion permission to a public utility company to occupy the streets with its pipe lines, it may grant such permission subject to such conditions as it may see fit to impose, provided they are not against public policy or in derogation of any right which the company may have under its franchise from the state. The municipality, by means of such conditions, may impose obligations upon the company which it would have no power or authority to impose under its general charter powers, and, if the company accepts the contract, it is bound by the conditions. These points of the law were discussed in the late case of City of Baker V. Montana Petroleum Co., 144 Pac. (2d) 735.

In this case it was shown that a city enacted an ordinance granting to a gas company a franchise to install and operate within or adjacent to the city a gas plant and to lay and maintain "conduits, mains, fixtures, and other apparatus for supplying and transmitting natural or artificial gas into the city, and in and through the streets, avenues, alleys, or public grounds thereof." The franchise included the ordinary provisions common to such grants and ordinances. It imposed upon the parties usual conditions. One section of the law provided for the payment by the gas company to the city of a percentage of the gross income received from sales of gas. The amount was to be paid annually and averaged 1% to 2% of the gas company's receipts.

The gas company accepted the terms of the ordinance and installed a gas distribution system shortly thereafter, and has operated the same as a public utility ever since. The percentages were paid annually in accordance with the provision for about 14 years. Then the gas company refused to continue making the payments on the contention that it is unlawful for any public utility to grant any rebate, concession, or special privilege which directly or indirectly effected a change of the rates, tolls, or charges of the public utility. The city filed suit to collect the agreed payments due. In holding the gas company bound to make the agreed payments, the Court said:

"The relation created between the city and the company was contractual in character, and the ordinance granting the franchise and providing for the percentage payments should be construed as a contract between the parties. . . . It is generally held that conditions such as that imposed in this franchise are not a tax or license, but rather in the nature of a rental or compensation for the use of streets."

Also, in another leading case, State, 173 Pac. 799, a franchise ordinance was contested which included the right of the gas company to use the streets. In upholding the validity of this ordinance, the Court said:

"The right granted to the company to use the streets for laying its mains is a franchise. * * * The acceptance of the franchise, which contained terms, constituted a contract between the city and the company, if the city had authority to make such contract."

All Kinds of Gas Included

Considerable controversy has arisen whether a gas company which holds a franchise to manufacture and sell *artificial* gas, has the legal right to distribute natural gas through its mains and sell it under the same franchise. This was considered by the Court in the recent case of City V. Gas Co., 49 F. (2d) 219.

Here it was disclosed that a city ordinance granted a gas company a franchise for a period of 25 years "with full right, power and authority to establish, construct, maintain, extend and operate a plant" *for the purpose of generating and furnishing to the inhabitants.*

Later the gas company desired to lay additional mains for the purpose of distributing and selling natural gas, but the city officials refused to grant the permit on the grounds that the franchise did not grant the right to the gas company to distribute and sell natural gas but only artificial gas. However, the Court ordered the officials to grant the permit for distributing and selling natural gas. This Court said:

"The sole question presented on this appeal is whether the gas company has the right to distribute natural gas through its existing system and to extend that system under the provision of its franchise. Of course, a public franchise is to be construed in favor of the public, but nevertheless it must be given a just and reasonable construction. . . . The main object to be achieved was the supply of gas for heating and lighting."

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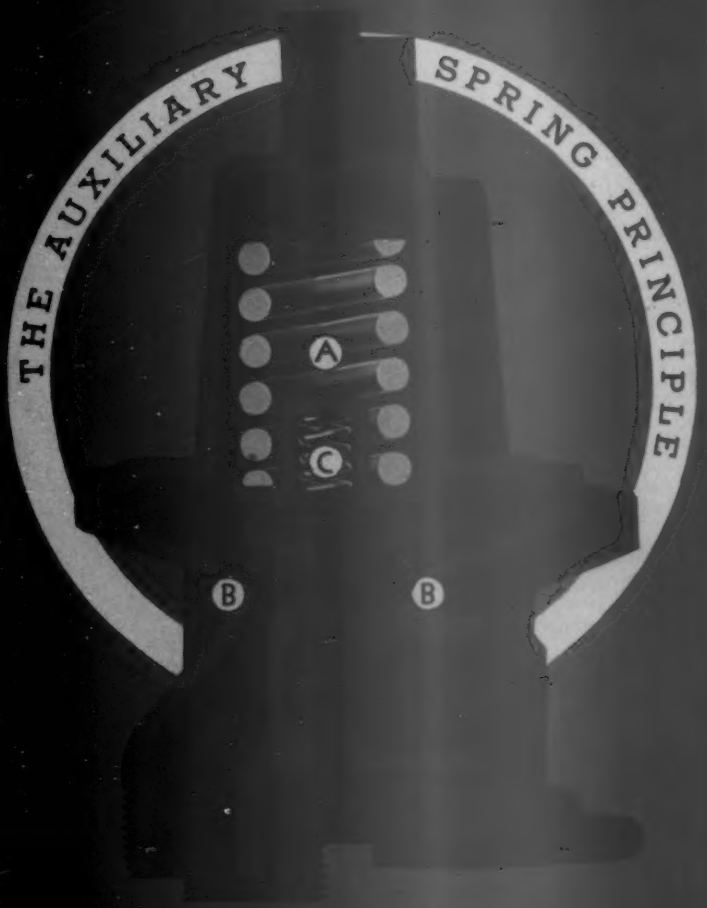

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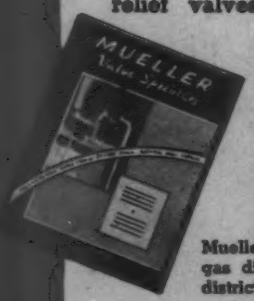
That is why this new Mueller principle of relief valve construction has been given such a resounding welcome. It assures an accuracy of operation that has never before been possible.

Practical experience has shown that the relief valve which opens easiest, and closes tightest, is a valve equipped with a comparatively SOFT composition seat. Hard composition will often groove into the seat and stick to it. After such a valve is opened, the hard disc is likely to be held away from the seat by foreign matter.

In the present line of Mueller relief valves a means has been devised to remove this heavy load from the disc. Note, in the illustration, that the pressure of the heavy diaphragm spring (A) is carried by stops (B-B) in the valve body. The light auxiliary spring (C) takes care of initial seating of the disc aided in service by the pressure within the body. Tests prove that valves so constructed positively open at the set pressure and close tight when the pressure recedes below the setting.

This principle is applied ONLY in Mueller Relief Valves. It is employed in all Mueller pressure relief valves, pressure and temperature relief valves, and pressure temperature and vacuum relief valves. It is also used in the relief element of the Mueller System for automatic control of hot water heating systems.



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MUELLER

Gas Pressure Controls

REPAIR AND INSPECTION OF LINE REGULATORS

By
Erick Larson
Gas Engineer

A TEST to determine the quality of the valve adjustment is to hold manually the valves firmly in a closed position, care being taken to keep the valve stem in its proper position so as to prevent any eccentricity of loading on the seats. The valve is then opened and the evenness of depression in the two valve discs noted. If one valve disc indicates that it has been indented by the orifice seat to a greater degree than the other, the spacing must be changed so that each valve disc will have as nearly identical indications of uniform closing pressure as the other. Where metal valves are used the comparative pressures may be noted by lightly smearing the valve surfaces with grease, lampblack or similar materials and slightly rotating the valve stem when the orifice seats and valves are in contact. Another method sometimes used is to place a piece of lead plate or wire between both valve disc and orifice seat, close the valve with as much pressure as possible and observe or measure the thickness of the lead at the point of squeezing. When this practice is followed it is desirable to place a lead wire on both sides of each valve to guard against any eccentricity affecting the spacing The practice of turning on gas while the valve is held in a closed position to determine any leakage should *be discouraged* as a safety precaution.

When valve discs which have been in operation are removed they should be examined carefully, before destroying, for indications of particular difficulties. Curling of the edges to a degree that would interfere with the flow lines of the gas in the regulator should be corrected. The most common cause of this curling is insufficient diameter of the valve disc resulting in the orifice seat being too near the edge and compression naturally tends to raise the edges. Excessive thickness of valve discs may also be a cause of curled edges.

Often soft valve discs will be found deeply scoured in only a small section indicating that the greater quantity of gas passes that particular area. The cause will usually be found in the design of a regulator rather than any easily remedied difficulty. However, the valve stem should be examined carefully for any eccentricity and the valve faces should be checked carefully to determine whether they are parallel with the orifice seats. Tar and gum deposits will also cause localized scouring by depositing on only part of the valve discs. Eccentricity between valve and orifice seats is readily apparent on used valve discs or carefully removed metal valves. The cause is frequently in the valve stem but may be in the valve assembly.

Attention to Valve Stem

During the repair of a regulator particular attention should be given to the valve stem guide provided on the bottom of most regulators to assure the absence of any foreign matter as only a slight clearance is provided and the space between guide and stem may become filled with foreign matter. The space in the bottom of or beneath the guide should be cleared of any foreign matter to eliminate the possibility of the valve being held in an open position because of inability of the stem to travel the full distance required.

During the repair of the major parts of a regulator, minor parts such as the pins at each hinge location should be checked to determine whether they are functioning properly. Turning each pin with a pair of pliers is an easy method for such a determination. It is preferable to grease these pins occasionally with a heavy lubricating grease rather than oiling on each inspection and repair. The very slight movement and infrequency of movement on each pin gives grease an advantage over oil as a lubricant. The cotter pins or any other method of holding the hinge pins in place should be examined to assure their being in place as vibration may cause a pin to slip out.

In some types of regulators a knife edge is provided on the top of the valve stem which fits into a carefully machined notch on the lever arm. Special care should be taken to see that the knife edge is in the proper slot as a slight difference in the distance between the nearest hinge and valve arm will cause a considerable difference in the regulation. The knife edge and notch should be examined for corrosion and means taken for prevention such as greasing or the use of inhibitive types of paints which also have a lubricating value.

When repairs are completed the regulator should be given a thorough test before placing in actual operation. Ordinarily the outlet pressure on the distribution system would not be sufficient to produce a complete closing of the regulator. For the test gas may be by-passed from the transmission line to the outlet of the regulator and by hand control a pressure produced which will completely close the regulator which pressure is then released either by opening the outlet valve or exhausted to the atmosphere. This operation should be repeated several time to produce a depression in the valve disc material when not metallic. The same process should be followed with metal valves as machining seldom produces a seat as perfect as will result from the continual wear which may be compared to the working in of motor valves. After the repetition of open and closing has been completed the inlet shut off valve is carefully opened to allow a gradual filling up of the reservoir on the outlet of the regulator until the lock up pressure is reached at which time the inlet shut off valve should be opened full and any build up of the outlet pressure noted. Should build up occur the process of opening and shutting the regulator should be repeated a number of times as often, with the increase in the depression of soft type valve discs, a seat will be provided which will hold tight at the lock up pressure setting and elim-

inate the necessity for taking the regulator apart. Should there still be a build up in outlet pressure the spacing of the valves should be checked together with the freedom of movement of the diaphragm or any other possible force restricting the proper movement of the valve stem.

With the use of soft type valve discs a tight shut off indicated by no building up of the outlet pressure with the outlet shut off valve closed should be a required test before the regulator may be placed in operation. On systems of five thousand meters or over there may be demand enough at all times of the day to consume the amount passing through the regulator when the regulator valves are virtually shut. However, as the system grows additional regulators may be installed the cumulative effect of whose flow with the valves shut would cause the system to build. Another factor is that the slight flow usually occurs at only one point or over a small distance along the seat gradually eroding the valve disc or valve at that point and resulting in ultimate failure of the regulation. The acceptance of anything but the perfection possible and practical leads to a careless attitude on the part of repairman.

When the valves are metallic it is practically impossible to secure a complete lock up with a reservoir limited to the space between the regulator and shut off valve. However the build up in pressure should be slow and slight as otherwise the regulator will fail in restricting pressures on the distribution system to a predetermined amount. The build up in pressure must be sufficiently slow so that a determination may be made of the point to which the system will build during off peak hours, otherwise repeated calls may have to be made to repair the regulator after examination of charts showing daily pressures.

A valuable check on the operation of a regulator after repair is to measure the travel of the valve stem between full open and full closed. Although this travel may be only between one half and and inch depending on the size of the regulator it will indicate any possible restricting of the valve opening. This check may be used also as a comparison between the functioning of regulators of the same size and design wherever located and often will lead to the causes of lack of sensitivity.

The number of turns on the static line needle valve may be important under many conditions and is usually checked at the time of each repair as an assurance that no changes have been made since the last repair. The value of any particular setting of the needle valve can only be determined by observation of the regulator during actual operation. While the regulator should be observed for a period of at least fifteen minutes after placing in operation the conditions during such observations may not be any criteria as to the value of the needle valve setting which then

LINE REGULATORS

Serial No. Make In Pit or Bldg. Pit Vented Yes-No
City Street Near
Original Installation of Pit & Gov. on Constr. Order # Completed
Present Gov. Installed on Constr. Order # Completed By
Remove Gov. Serial # Returned to On Constr. Order #

INSPECTION AND REPAIR						
Date						
By						
Conditions Arnd Top of Pit						
Water In Pit						
Odor of Gas in Pit or Bldg.						
% Gas Mixture						
Blower Used						
Mask Used						
FIRST CHECK OF SETTINGS BEFORE REPAIR						
Time						
Inlet Pressure						
Outlet Pressure						
Lock Up						
FINAL SETTINGS AFTER REPAIR						
Inlet Pressure						
Lock Up						
Time Turned On						
Turns On Needle Valve						
# & Wt. of Wts. On Hanger						
# & Wt. of Wts. On Lever Arm						
Seats Changed and Reason						
Main Diaphragm Changed & Reason						
Aux. Bowl Dia. Changed & Reason						
Grit on Seat						
Sample of Dust Left With						
Remarks						

Form for Report of Inspection and Repair.

must be determined by a close study of recording pressure charts. On many distribution systems the needle valve may be left wide open without affecting regulation to any practical degree.

Inspection Report

Illustrated herewith is a report required on one system for inspection and repair of line regulators. The object of this report is not only to provide a filed account of such inspection and repair or to provide superintendents and managers with an indication of the nature of repairs, but is also to assist the repairmen in recalling all of the particular functions of the regulator which are to be checked, as a guide in the routine to be followed and also an indication of the work done on previous repairs so that any continuously recurring trouble may be permanently repaired or the regulator removed for observation under more favorable conditions.

The first section of the report may be termed the general observations and conditions. The conditions around the top of the pit are in the nature of safety requirements and indicate whether surrounding conditions are safe for pedestrians and vehicular traffic. Should it be found that there is a gas mixture in the regulator housing and no leaks can be found on any of the accessible apparatus the natural result would be to determine whether gas was seeping into the structure from an external leak and report such findings for correction.

The second section reports conditions as found previous to inspection or repair. The time often will be found to be an important element as it will be indicative of the reason for possible complaints of lack of service should the regulator be shut off and by-passing neglected. In connection with this section it is usually required that a recording gauge be set as close as possible to the outlet side of the outlet shut off valve and the chart attached to the report. Such a chart would indicate any failure on the part of repairmen to observe the pressure conditions on the distribution system or failure to maintain a proper pressure on the outlet by means of by-passing.

The last section is to provide a proper historical record of the conditions after repair. Particular attention should be paid to the section on the amount of weights used on the hanger or lever arm. Should a change in regulation be apparent on recording charts the amount of weights used to balance pressures naturally would be one of the first checks made and if the weights were different in quantity a plausible explanation of the change would be evident. When regulators are spring loaded it is practically impossible to explain change in regulation due to changes in the balancing force as there is no means of measuring the compression of the springs in practical operation.

While the recording of balancing weights may not seem important considering how few men ordinarily have access to regulators experience has demonstrated that there are many situations when men not familiar with repair work on regulators are called upon to furnish information or observe the operation of the regulator and who unintentionally may change weights. This latter condition is particularly true where the weights are arranged to slide along a lever arm and under such conditions an added line should be placed in the final section of the report to indicate the distance of the weight from some fixed point.

The report indicates that a sample of foreign material was removed from the interior of the regulator and left with some particular person. Periodic collecting of foreign material and subjecting the samples to a physical and chemical analysis is valuable in indicating not only the source of regulator trouble but also may indicate potential sources of internal trouble in the distribution system. The nature of this trouble may be internal corrosion of mains, moisture, particles originating in the manufacturing plant or wells, etc., and may explain other difficulties such as the cause of meter valve failures, a high percentage of house regulator blows, and the reason for service stoppages. The value of the regulators as a collecting agency lies in the fact that considerable volumes of gas pass through the regulator, therefore, the regulator is an excellent collecting medium and the results may be observed periodically.

Routine Inspection

While it is a valuable precaution to replace diaphragms and soft type valves at least once a year or oftener under extreme conditions, a complete inspection is usually made more frequently especially just previous to and just after the peak season. Where the conditions during the peak season place exceptional demands on the regulators an additional inspection during the season may be valuable in the prevention of trouble and allow repairs to be made during off peak hours rather than have a regulator fail when service is of prime importance.

After the original installation of a regulator a daily inspection should be made for several days following the initial day of service then once a week for two or three weeks the frequency being determined by the difficulties found.

The inspection follows the same routine as repair with the exception that parts are not actually replaced. The first routine matter should be an observation of the actual functioning of the regulator for a period of at least fifteen minutes which when possible should be made during the peak load of the day. The sounds emanating from a regulator in operation are as indicative to an experienced repairman who has acquired the habit of listening as lung sounds are to a physician. Stethoscopes have facilitated such a diagnosis but a small screw driver placed against various parts of the regulator body and the ear is an excellent substitute. Sound may be used to determine which of two or more regulators in parallel or which of many in a district is passing the greater quantity of gas. Observation of moving parts will disclose difficulties such as sluggish operation, sticking, pulsation, hunting, peculiar variations in load which may warrant investigation, etc. The regulator is then shut down and a test made of lock up pressure. The next step is usually draining all gas from the interior of the regulator and determining freedom of motion of all possible moving parts by hand operation.

Since the seats are the cause of greatest trouble they should be thoroughly inspected for wear, foreign matter, even seating and drying. Some means of bright illumination of the regulator interior is essential as feeling is not a satisfactory method of determining valve condition. The diaphragm is examined for drying, cutting, wearing, insufficient or excessive play, pulling from between flanges, flexibility and foreign matter.

While testing for gas leakage may be restricted to locations where an odor of gas is evident any oil leaks should be investigated to determine their cause.

A careful observation of the daily or weekly charts recording the pressure conditions on the distribution system partakes of the nature of regulator inspection as it is a source of information as to the functioning of the regulator.

How Valuable Is Your Window Space?

By STUART BRATESMAN
Manager, Display Dept.
Boston Consolidated Gas Co., Boston, Mass.

IN THESE days of increased advertising efforts, it is a good plan to "take stock" of the various media you have at your command to get your sales and service messages to the public. One of the most valuable, and yet the least expensive, is your display windows. Do you place any value on these spaces?

Look around your section of the city or town. Notice how advertisers utilize every possible space for their messages. These spaces invariably run into money, and are rented to the highest bidder. In your own building, you have such valuable advertising spaces . . . your windows.

Regardless of whether a hundred people pass your windows during a business morning, or a thousand, these areas have a very important place in the set-up of your merchandising program. Progressive gas companies have long ago realized their value and used them to good advantage. They are one advertising medium that combines the twenty-four hour "working day" with third dimension for displaying the latest gas equipment. If you haven't already done something about your own window spaces, the writer would like to suggest you make a determined effort in their behalf, at the first possible moment. This doesn't necessarily mean installing an elaborate display organization. The average small gas company cannot include the expense of such an activity on its budget, especially if it possesses but a few windows.

A small expenditure and a few hours after business each week will be well repaid in interest and sales. As for ideas, any trade publication, the American Gas Association Window & Store Display Bulletin or this series of window display articles have more than you could possibly use. Help yourself.

Many manufacturers also have actual window display material available which is most effective. Get in touch with their representatives in your community. You don't have to possess a big display staff to utilize your windows effectively. The main thing is to do something about them, right now.

Here are two rather timely suggestions for this month. The automatic gas house heating display has what we call the human interest punch, which is always arresting in advertising. No effort is made to show the actual features of the equipment. A small mounted photostat of the latest gas boiler gives the reader a good idea of what the equipment looks like. The effortless "tending" of an automatic gas furnace is the thought presented in this set. The entire design was painted in tempera water color paints on beaverboard. All areas were white, grays and black, except the orange circle. This focussed attention on the gas heating copy. Hidden trench lighting lent additional effectiveness to this display.

The other educational set used the appeal of fall motoring as its subject. This is the time of year when people like to drive out in the country and enjoy the bracing air and foliage colors. A display of this type is of decided interest, at this time.

To Increase Gas Sales, We Must Solve Basic Sales Problems

By
Gas Sales Manager

The two greatest sales problems of the gas industry, declares this writer, are constructive dealer relations and the scientific use of credit terms which will bring large territories of present low saturation into the active promotion zone.

TIME—Recently.

PLACE—The home of a gas customer on Main Street.

ACTION—Mrs. Nichols discovers that her water heater, bought of the gas company years ago, is leaking badly, and telephones the nearest plumber, James Thompson, who immediately drives to the home. He does not attempt a repair, deciding that he has a good opportunity to make a sale of new equipment, and leaves for his shop with the promise to return soon.

Getting to the shop, Thompson calls up the gas company's sales department, and gets prices on new equipment. Our gas company is one of those which cooperates with the retail trade of its territory by selling any of its lines on a wholesale basis. The plumber hangs up after saying that he thinks he has a sale over on Main Street.

The housewife, however, becomes impatient, for Thompson hasn't returned, and calls up the gas company's service department. Before the service man leaves, however, the sales department, identifying the call as the one inspiring the inquiry by the plumber, carefully instructs the service man to be very careful. He is not to talk new equipment at all. If the housewife brings up the subject of new equipment, he must evade, going no further than to recommend that the plumber, Thompson, be consulted.

The service man repairs the leak, whereupon Mrs. Nichols insists on information about an automatic heater. She will not listen to the suggestion that she consult the plumber, Thompson. When Thompson several hours later returns to the house, he is informed that the leak has been repaired; when he talks new equipment, he is met with the lady's emphatic statement that she is going to buy of the gas company. Curtain.

Dealer Relations

I have related the foregoing incident because it is typical of the sort of thing which continually is arising, and must always arise, so long as gas companies are selling merchandise which retailers also sell. The company was my company, and, as I have indicated, we were absolutely blameless of any intent to take advantage of the plumber. The latter, however, did not know that the consumer had called our service department. The facts, as they appeared to him, were (1) he had, by calling us to get prices, revealed a "hot" prospect, (2) immediately, a gas company representative had contacted that prospect, and made a sale. To Thompson—and one cannot blame him very much—it looked like a perfect double-cross.

He proceeded to call us on the telephone, and what that man didn't say!

Here is another recent case to match it. Our planning department had worked with a plumber on a house heating job. It is our inflexible rule that such service is absolutely confidential. We permit no "leaks" to the sales organization, the understanding being that the whole deal shall be left entirely to the plumbing and heating concern we are aiding. We do expect that if the dealer is unable to complete the sale after a considerable period we shall be given the privilege, freely, of attempting to make the sale ourselves.

Well, in the case I mentioned, the service had been performed for the dealer. A considerable period had elapsed, and one of our salesmen was instructed to look into the matter.

The intention was that he should first contact the dealer, and ascertain the status of things, only continuing his own efforts if the dealer voluntarily released the prospect. Through misunderstanding, the salesman did not do this, but went direct to the prospect—and made a sale.

Imagine the language of the plumber, a man with a colorful vocabulary, when he learned of the sale!

As in the first case just related, he was firmly convinced that the gas company had double-crossed him.

I am relating these two cases because they point to perhaps the most important basic sales problem that industry has today.

I handled both of these situations personally, and in each case considered nothing done that day of greater importance. It took a full two hours of discussion with Thompson, in his shop, to straighten him out, convincing him that the gas company was playing fair, and was ready to cooperate with him with the actual desire to increase his business.

We have succeeded in securing the confidence of a considerable percentage of the membership of the Plumbers Association. We always attend meetings; we make donations. We go far more than half way in adjustment situations which arise. We strive, specifically, to get a dealer into the habit of coming into our offices to talk with us, because we know from experience that with these plumbers we have very little difficulty. If a misunderstanding arises, we readily straighten it out.

Salesmen on commission are human. In sales-training, and supervision, we are constantly working to create a group of men who are 100% successful in maintaining a high ethical attitude toward all competition. And, specifically, we require individual and detailed reports on all sales where there is any reason to believe there are "complications" affecting a plumber, furniture dealer, or other retail competitor. We know from experience that, if we know a dealer nurses a grievance, we can "bring him out of it." It's the cases that we do not know of that are dangerous.

Most of the retailers do not realize that, with the assistance we are happy to give them, they are in a far better position to cash in on gas merchandise sales than "going their

own." And gas companies must realize that there are great opportunities in educating and training dealers, so that they create and produce sales in far greater volume than they have in the past. The first task in gas promotion of the immediate future is right here, in my opinion.

Instalment Terms

To realize maximum increases in gas sales, we must scientifically exploit the sales possibilities of instalment terms. There is no quicker, simpler way to quickly increase gas equipment sales than by reduction in terms. I have particularly in mind two items—automatic water heaters, and house-heating equipment.

We are selling water heaters now with a $1.50 monthly payment, terms which are extremely liberal by comparison with former ones, yet our experience is such that I am convinced we can safely sell with $1.00 monthly payments.

The significant fact is that, in instalment selling, a gas company is in a field by itself. There is no question that we can profitably and safely sell on terms which an ordinary dealer cannot touch. The fact that we are continuously selling a service, commonly indispensable, to the consumer, and that the latter will be our customer indefinitely for service, completely alters the instalment credit situation.

The fact that we are principally interested in increasing load gives us an opportunity to pursue an approach which instalment sellers usually can have no interest in. I mean the definite engineering of products with the double view of high utility and long life, and very low terms.

Like other gas sales managers, I keep closely informed of saturation points by districts. I have neighborhoods where water heater installations are as high as 95%, while house-heating installations are above 40%. I have other districts where the percentages, respectively, are not more than 3% and 8%.

I see whole sections of the town that are largely virgin ground, and where the conveniences of water heaters and gas-heating would be as great a blessing to home owners as in the districts of high saturation, the latter being, of course, the ones where people of a high average income live.

Studying this picture, I find two answers to the question of increased sales. One is outside our control; I refer to a general increase in consumer incomes. The other is a much more efficient adjustment of cost to the individual, with the offer of terms much more liberal than those now available to him.

Our house-heating terms at present are very liberal, judged by former instalment selling standards, but I believe that we are coming to terms which are far more adapted to the average customer's ability to pay. Our current experience indicates that the immediate future from several angles will be a favorable time for modification of terms. We have a public which is essentially conservative in estimating its ability to assume obligations. The level of consumer credit ratings has reached bottom and started up, and the next few years are likely to witness steady improvement in consumer ability to pay. In other words, the tide is likely to be with that company, very strongly, if liberalized terms are introduced.

Mind you, I am suggesting that more liberal terms be offered only after the "closest" and exact study, and then subject to controlled study. I realize, too—reverting to the problem with which I began this discussion—that there is a public relations, as well as a credit, aspect of the subject. Already, gas companies are extending terms which a great many dealers cannot meet, and, as we all know, right there is one of the sore spots in our public relations.

To offer more liberal terms still will obviously stir renewed antagonism among retail dealers. What is to be done about this?

The public relations man can find various answers to this. Personally, I feel that gas companies should be vitally interested in seeing that all legitimate sales outlets are in a position to sell safely and economically upon very liberal terms. Manufacturers should be equally interested. It seems to me that there should be some team work with a genuine determination to bring about a reasonable clarity.

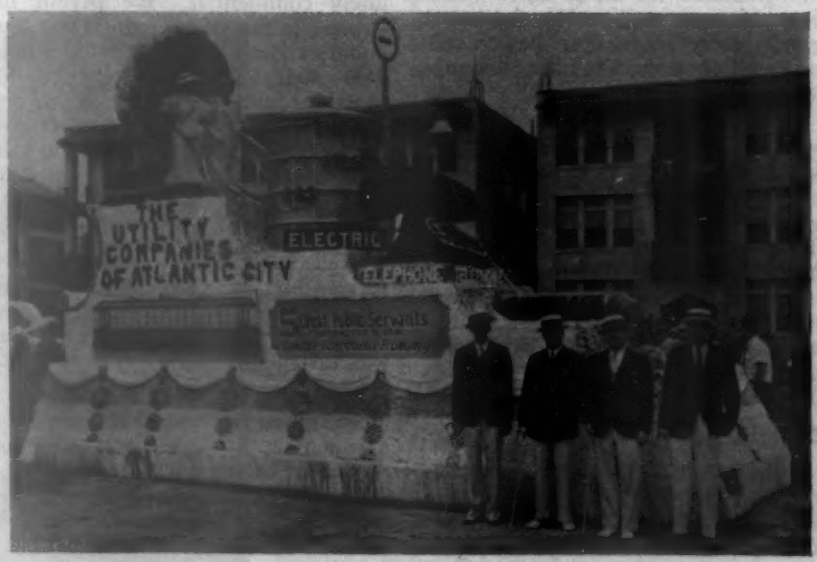
This discussion seems to sum up to the conclusion that team work is both the opportunity and the problem in gas sales promotion.

Atlantic City Utilities Float in Showmen's Variety Jubilee Parade Awarded Prize

The five utility companies of Atlantic City, N. J., entered a float in the Showmen's Variety Jubilee Parade, Saturday afternoon, September 7th, 1935, and were awarded third prize.

This float represented the Atlantic City Gas Company, Atlantic City Electric Company, Atlantic City Sewerage Company, New Jersey Bell Telephone Company and the Atlantic City Shore & Railroad Company. The models on the float represented the individual companies and the two girls represented "Miss Utility" and "Miss Consumer."

This float was very well accepted by the 200,000 visitors and natives of our community who viewed the parade, which was about three miles long. This combining of the utility companies created a very favorable impression.



Representatives of Utility Companies and Float Entered

Domestic Gas Utilization*

Water Heating Division — Part VI

What Size Heater?

By

Charles W. Merriam, Jr.

Div. Commercial Manager, Roanoke Gas Light Co.
Roanoke, Va.

ABRAHAM LINCOLN is reputed to have replied to the query as to how long a man's legs should be, "just long enough to reach the ground." This quaint rejoinder serves as a case in point for the puzzling question that baffles most salesmen, namely, what size water heater—the simple answer is "just large enough to serve the particular customer's needs and *nolarger.*" Manifestly the two factors of storage capacity and hourly recovery must be so combined for each home as to result in a given heater having a service capacity such as to permit the proper ability to supply the individual customer demands. Excessive largeness in such service capacity spells reduced thermal efficiencies with commensurately increased operating costs whereas an insufficient ability to deliver the required hot water when demanded constitutes a service failure—both can be avoided by careful matching of the heater's service capacity to the individual requirements.

Several time-worn rule-of-thumb methods for sizing gas-fired storage water heaters are still in rather common use but for the most part these haphazard methods lead to selections which are deplorably wide of the mark. Unfortunately the general result of the application of these rules-of-thumb has been that so many installations of ill-considered sizes have been made that a distressing majority of the automatics in American homes are absurdly large (either in storage capacity or in Btu. input—or both). This needless provision for excessive service capacity has, however, been a concession largely to the sellers' stupidity or shiftlessness but with the purchasers paying the bills. Or have these mistakes been at the public's expense? That is very doubtful because the process has been sort of "killing the goose that laid the golden egg," with the inevitable consequence that the public shuddering over the operating cost of automatics has established in some quarters a genuine but well-founded sales resistance, a condition more in evidence in manufactured gas areas where the cost per potential Btu. is relatively higher. In the past many manufacturers in their desire for fat profits foisted off, perhaps unwittingly, a great many over-sized heaters. In astonishment both they and the utilities have witnessed a shrinking market with sad lamentations for their past misguided zeal in providing unnecessarily large service capacities.* Hope of reversing this trend lies to a great extent in more appropriate size selection by the ultimate dealer which if earnestly pursued can bring about a high degree of customer satisfaction and broader public acceptance.**

In previous articles of this series we endeavored to pick to pieces the problem of how to ascertain what the probable demands might be expected to be in any given home. In substance the analysis demonstrated that primarily the hot water demand per average day varied according to the number, age and sex of family members and also to the mode and routine of living. A method has been advanced whereby within reasonable limits of accuracy determination could be made of how these requirements for hot water at a stated temperature fluctuated between the various hours of the day and night in an individual home. In addition to the distribution of gallonage demands throughout the day the fact was established that the temperature rise was inseparable from the problem of heat input requirements. In short it develops that to accurately arrive at the required relationship between storage capacity and Btu. input it is necessary to decide on the following:

1. Hot water withdrawal, or demand, schedule expressed in gallons.
   a. Daily
   b. Hourly
2. Temperature rise in °F.

In such data to know the maximum hourly withdrawal and when such occurs is of importance. This information must be ascertained for the maximum day's use since size selection must be such as to supply the most severe demands encountered. For the purpose of this article the supposition is that these sundry conditions are known.

Two possible lines of approach are open with an automatic storage type of heater by which the problem of the fluctuating hourly demands may be met and solved; namely, a large storage with a low rate of heat input or the reverse relationship of a small storage with a high heat rate of input.*** Before proceeding

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** The story is related of a superintendent back in the 90's erecting the metal work of what then was a tall building. An interested passerby on witnessing an enormous beam being jockeyed into place asked the "Sup" how he determined the size of said cross member. The reply was, "Figured it". The retort was "Oh yeah!" "Yes, then I multiplied it by two." "And then what'd you do?" The "Sup" closed the sparring around with, "put one in I knew damnwell would hold 'er up". Many salesmen in recommending water heaters have followed this general program of knowing "damnwell she'd give 'em* beaucoup *hot water."*

*** Familiarity with the initial article of this series, "Engineering ABC's", will aid in penetrating this phase of the water heating work.*

**** Size determination for the automatic instantaneous type of water heater centers around the number of gal. per min. desired which in the final analysis is directly related to the number of hot water faucets expected to be in use at any given moment. The approximate 3 or 4 gal. per min. size which is capable of supplying one fixture at a time, is the commonest in domestic use. Close attention must be given to the probable maximum temperature rise with the instantaneous type in that with a fixed Btu. input the gal. deliverable are a direct function of the temperature rise.*

with the intricacies of calculations on size selection the stating of two definitions of two common terms will facilitate matters. The "margin of storage reserve" presents the minimum storage of hot water existing in the tank at any one time, or stating the definition in another manner the "margin of storage reserve" is the least number of gal. of hot water available in storage to satisfy the then existing demand. The "point of greatest cumulative demand" is that point at which the greatest inroads have been made on the stored hot water at any one time as brought about by the previous hot water withdrawals minus the effect of the recovery capacity, which in turn is conditioned by the rate of heat input. The significance of this is apparent when it is realized that the ability to meet a sudden large withdrawal from the hot water then in storage is not necessarily the full storage capacity of the heater nor can the heat input in the storage type hardly be expected to be great enough to concurrently supply a large instantaneous demand. In other words, the "point of greatest cumulative demand" plus the "margin of storage reserve" is equal to the total original storage capacity of the heater. Obviously the highest efficiency is obtainable when the "margin of storage reserve" is at a minimum or conversely when the "point of greatest cumulative demand" approaches most closely the storage capacity of the heater. These two definitions will become more clarified upon application directly to actual individual problems later on.

Let us first examine into the number of gallons of hot water obtainable in any one hour with varying heat inputs and temperature rises as set forth:

RECOVERY IN GAL. PER HOUR AT VARIOUS BTU. INPUTS AND TEMPERATURE RISE*

Rate of Btu. Input	*Temperature Rise, °F.*								
Per Hr.	*40*	*50*	*60*	*70*	*75*	*80*	*90*	*100*	*110*
2,500	5.6	4.5	3.7	3.2	3.0	2.8	2.5	2.3	2.0
3,500	7.8	6.3	5.2	4.6	4.2	3.9	3.5	3.4	2.9
4,500	10.0	8.1	6.8	5.8	5.4	5.1	4.5	4.1	3.7
5,000	12.3	9.9	8.3	7.2	6.6	6.2	5.5	4.9	4.5
6,500	14.6	11.7	9.8	8.4	7.8	7.3	6.5	5.8	5.3
9,000	20.3	16.2	13.5	11.6	10.9	10.1	9.0	8.1	7.4
10,000	22.6	18.0	15.0	12.9	12.1	11.3	10.0	9.0	8.2
12,000	27.0	21.6	18.0	15.4	14.4	13.5	12.0	10.8	9.8
15,000	33.8	27.0	22.5	19.3	18.0	16.9	15.0	13.5	12.3
18,000	40.5	32.4	27.0	23.2	21.6	20.3	18.0	16.2	14.7
20,000	45.0	36.0	30.0	25.7	24.1	22.6	20.0	18.1	16.4
25,000	56.3	45.0	37.5	32.2	30.0	28.1	25.0	22.5	20.5
30,000	67.5	54.1	45.0	38.6	36.0	33.7	30.0	27.0	24.6

* Thermal efficiency is here assumed as being 75%, other efficiencies will produce, of course, directly proportional hourly recoveries.

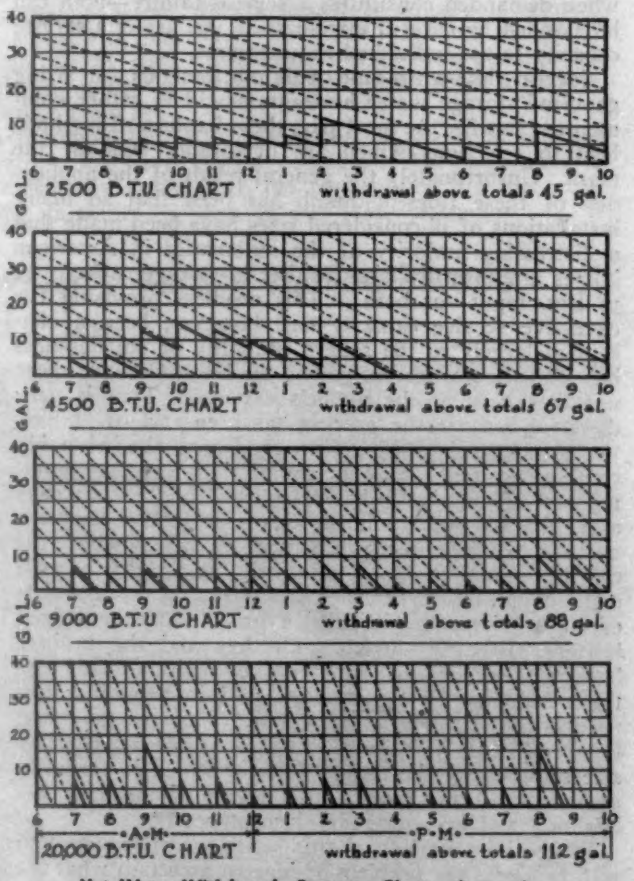
A glance at the above will reveal the astonishing ability of gas heaters in the range of heat inputs now marketed to recover normal hourly withdrawals at ordinary temperature rises. As an illustration take for instance a 10,000 Btu. input at an 80°F rise is capable of making available 11.3 gal. in any one hour or 271.2 gal. per day if running continuously—an enormous amount of hot water judged in the light of domestic use. Consider also, that 11.3 gal. is surely sufficient hot water for a fair sized bath. Despite this, however, the "point of greatest cumulative demand" may be such that a total storage capacity of perhaps 30 gal. might be necessary to meet other demand requirements. Each heater carries a manufacturer's name plate on which is imprinted the Btu. input rating per hr. in the quick translation of which into gal. per hr. the accompanying recovery capacity table will be helpful.

The next logical step is to relate these recovery capacities together with standard storage tanks to some specific withdrawal schedules. The tabulation below contains sample hot water draw-off schedules such as might conceivably be encountered in homes on the day of greatest usage:

Hour	*Hot Water Used, Gal. per hr.* Col. 1	Col. 2	Col. 3	Col. 4
6 A.M.	0	0	0	0
7 A.M.	5	5	7	8
8 A.M.	2	6	5	8
9 A.M.	4	12	7	18
10 A.M.	3	7	5	8
11 A.M.	3	3	5	7
12 Noon	2	2	4	4
1 P.M.	3	3	5	5
2 P.M.	8	8	8	8
3 P.M.	0	0	8	8
4 P.M.	0	0	2	3
5 P.M.	1	1	3	4
6 P.M.	2	2	3	4
7 P.M.	2	2	4	6
8 P.M.	8	8	10	16
9 P.M.	0	6	8	0
10 P.M.	2	2	4	5
Total gal. daily	45	67	88	112

Bear in mind that these four withdrawal schedules were taken at random as being typical of normal maximum day conditions in average homes with different total daily gal. requirements.

As a visual aid to a practical means of matching these foregoing four withdrawal schedules with some reasonably satisfactory combination of Btu. input and storage (i.e., service capacity), the accompanying illustration called Hot Water Withdrawal-Recovery Chart has been devised. This chart is divided into four divi-



Hot Water Withdrawal—Recovery Charts—Assumed temperature rise 80°

sions, each for a different rate of heat input. In this chart time according to hours (horizontal) is plotted against gal. withdrawals (vertical). In addition the chart endeavors by the inclined lines to show the offsetting effect of the heat input on store remaining after the water withdrawals. The inclined dotted lines represent the rate of recovery at 80°F temperature rise caused by the combustion at 75% burner efficiency of the four heat inputs per hr. as given, respectively, for each of the four divisions, 2,500, 4,500, 9,000 and 20,000 Btu. By way of illustration let us assume that at 7 A.M. the tank is completely full of hot water but that 5 gal. are withdrawn. During the ensuing hour 2,500 Btu. are consumed in the heater, hence 2.8 gal. of hot water are recovered thus leaving 5.0 — 2.8 = 2.2 gal. remaining to be heated. But at 8 o'clock another 2 gal. are removed, thus making 4.2 to be heated of which the 2,500 Btu. input will recover 2.8 thus leaving a deficiency of 1.4 gal. at 9 A.M. at which time 4 gal. more are withdrawn, etc.

The foregoing withdrawal schedules, Col. 1 to 4, are plotted, respectively on the four parts of the chart, showing thereon the recovery effect of the inclined Btu. lines aforementioned. Thus the hot water usage in Col. 1, namely the 45 gal. total distributed in the hours shown, is plotted on the 2,500 Btu. chart and the 67 gal. on the 4,500 chart, etc.

Study of this chart will reveal some surprising circumstances. According to this chart each of the withdrawal schedules as plotted thereon is seemingly amply provided for with only a 20 gal. tank storage by the respective Btu. inputs against which each is plotted. For instance, on the 2,500 Btu. chart at 2.00 P.M. the hot water withdrawal has been offset by the heat input so that effectively a 12 gal. removal has taken place (referred to as the "point of greatest cumulative demand"), which leaves, if a 20 gal. storage heater were used, 20 — 12 = 8 gal. of hot water remaining (commonly styled "margin of storage reserve"), or with a 30 gal. storage heater 18 gal. of hot water remaining. When judged in this analytical light it is apparent why slow and medium recovery heaters with their higher service efficiencies are fast gaining popularity. The 20,000 Btu. chart indicates forcefully what a whale of a job the high heat input heaters are capable of doing. In this 20,000 Btu. chart shown, note that although the withdrawals are extremely heavy with large peak hourly demands, full recovery has occurred within the hour, thereby making the entire total storage capacity of the tank available to supply subsequent requirements. A study of this character vindicates the belief held in most informed quarters that only in the rarest of domestic cases need a 20,000 Btu. input heater be any larger than 20 gal. storage.

In actual practice, however, a few seemingly academic refinements are unavoidable for accuracy's sake. First we must figure on standby losses, of which there are none on the 2,500 Btu. chart from 7:00 A.M. to 10:00 P.M., but on the other three charts there are periods during the day when heat must be supplied to counteract standby loss, which, however, with relation to the total hourly Btu. input, is small. This latter is true especially with the medium and higher input ratings. Depending on the size, storage temperature and design of the heater, this standby loss will range normally between 700 and 1,800 Btu. per hr. when the burner is not operating on most heaters now marketed. Second, there is a lag in the operation of all mechanical thermostats which allows the average tank temperature to fall appreciably before acting, thus permitting a temporary lessening of average storage temperature that conceivably could cause unsatisfactory customer service if occurring during the period of low "hot water reserve." The third factor concerns the lessening of water temperatures around the hot water outlet if the incoming cold water (occasioned by hot withdrawals) has sufficient churning action inside the tank. Although these three factors are relatively trivial, some weight should be allowed these when dealing with the margin of storage reserve.

In addition to the hot water withdrawal schedule and the three factors just mentioned (standby loss, thermostat lag and internal churning) the calculated margin of storage reserve should make due provision for unforeseen customer demands. By force of circumstances the minimum "margin of storage reserve" in relation to the "point of greatest cumulative demand" must be arbitrarily established for domestic practice. After considerable study and actual experience the recommendation is that the storage capacity selected be:

1. For heaters of 9,000 Btu. input per hr. or less, storage be 200% of the "point of greatest cumulative demand."
2. For heaters of from 9,000 to 15,000 ,Btu. input, storage be 160% of the "point of greatest cumulative demand."
3. For heaters of over 15,000 Btu. input, storage be 135% of the "point of greatest cumulative demand."
4. No heater with 4,500 Btu. or under be less than 30 gal. storage (except in rare cases) and no heater of 17,500 Btu. or more be less than 12 gal.

No rule of this type can replace sound judgment born of personal experience.* With the hot water demands known, a little "cutting and trying" with these Withdrawal-Recovery Charts will reveal in each instance the most practical combination of heat input and storage within the limits of standard equipment now marketed.

A little practice with these Withdrawal-Recovery Charts very soon demonstrates that wholly satisfactory automatic water heating service for the big majority of American homes can be secured with small storage and medium heat input heaters, provided the demands in any one hour are not extraordinarily excessive. In endeavoring to effect the utmost economy in size and heat input it is suggested that in this selection of size the following five circumstances be given special thought in determining peak demands:

1. Likelihood of simultaneous baths in homes with two or more bathtubs.

**In seasoning sales judgment in the proper size selection of automatic heaters the employing of similar Withdrawal-Recovery charts has been in some cities actually carried into estimates for individual homes with gratifying results. The mechanical construction of such charts in blank form, each rate of Btu. input in the equipment currently handled being laid out on 8½" x 11" coordinate paper, is a simple task. The slope of the inclined, dotted lines can, in each case, be readily determined from the Recovery tabulation as present in the foregoing and accordingly drawn onto the chart. Having plotted the blank forms the making of blueprints therefrom will afford a convenient means of studying each separate problem. In applying a given withdrawal schedule to one of these blank charts the use of a yellow pencil and triangle will facilitate the procedure.*

In dealing with the volume retail market the Withdrawal-Recovery Chart as a method doubtless involves too much detail work to warrant general and indiscriminate use. The chief worth is in molding judgment from an educational standpoint or in offering an adjunct in "cracking the extra tough nuts" for whom written, "tailor-made" proposals are calculated to have a special appeal.

2. Likelihood of numerous shower baths taken in quick succession.
3. Large family wash, including all flat work being done at home.
4. Probable temporary increase in number of residents such as house guests, week-end house parties and children vacationing from preparatory schools and colleges.
5. Stubbornness of the customer in refusing to either adjust the mode of hot water use to reasonable heater capacity or to be reconciled to high gas bills.

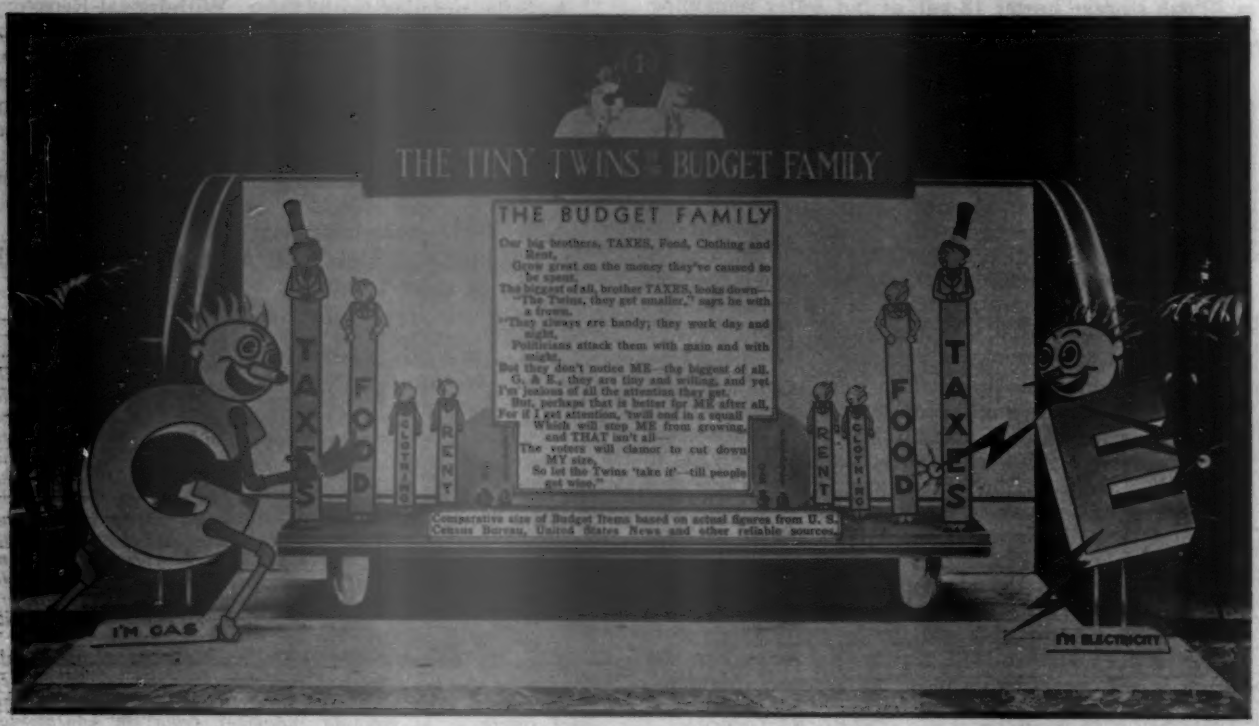
The recommendations as to "margin of storage reserve" previously mentioned will cover the first four of the above in perhaps 75% of the homes. Number 5 above is a most debatable subject. If the purchaser desires hot water service without limit the only answer is ample storage and quick recovery. If, on wash day, madam wishes to at one time have the laundress literally drawing tubs full in the basement and the maid lavishly washing dishes while she is simultaneously luxurating in a Turkish bath under the shower, it can be accomplished only by exacting the penalty of higher stand-by losses during the inevitable off peak periods. By reasonably modifying the household demands it is not necessarily implied that one must be *sold* on the idea of completely changing the routine of living or of carefully accommodating each domestic action to the speed of the water heater in the basement—merely the exercise of a "wee dram" of discretion in not expecting the impossible. It's the old story sometimes of expecting the 5-ton truck to have the speed and relative economy of a passenger car.*

Familiarize yourself thoroughly with the use of these Withdrawal-Recovery Charts—they'll eliminate a flock of headaches. When the storage size and the heat input rating has been selected for a given home, and the total monthly hot water consumption in gal. estimated at the probable average temperature rise, then reference to the preceding article of the series on "Gas Consumption For Water Heating" will establish the gas use and hence permit calculation of the cost of operation on the appropriate local gas rates. The following of this method of procedure will almost infallibly result in a rational answer to those who ask that inescapable question of "what size and what original cost and what operating cost?" With these tools as delineated in the foregoing when coupled with a modicum of commonsense perseveringly and persuasively employed, selling success cannot evade your efforts.

The vast majority of tank water heaters have an input rating of 20,000 Btu. and are hooked up to an uninsulated standard range boiler of 30 gal. storage capacity. Reference to the preceding tabulation on recoveries establishes that roughly the tank heater can produce approximately 20 gal. of hot water per hr. through a 90° F temperature rise. In other words, being manually operated a time period of one half hour must elapse after being lighted before 10 gal. (a fair quantity for a bath) can be secured. The inherent nature of the tank heater as a means of supplying hot water imposes no pressing problems comparable to those of the automatic storage type as to size selection by virtue of its very character and the manner of its use.

(Continued in November issue)

**One can scarcely labor through these size determination calculations without having spring to mind the manifold advantages, at least as to size considerations, of the variable input type of heater commonly marketed under the trade name phrases of "Customer-Control", "High-Low", etc. The problem of such peak demands as the daughter-home-from-college, the week-end guests, Monday morning wash, the Saturday-night-bath-institution and the like finds an appropriate solution while still allowing the operating economies of the low input heater for the balance of the time.*


THE TINY TWINS of BUDGET FAMILY
THE BUDGET FAMILY
Our big brothers, TAXES, Food, Clothing and Rent,
Grow great on the money they've caused to be spent.
The biggest of all, brother TAXES, looks down—
"The Twins, they get smaller," says he with a frown.
"They always are handy; they work day and night,
Politicians attack them with gain and with might,
But they don't notice ME—the biggest of all.
G. & E., they are tiny and willing, and yet
I'm jealous of all the attention they get.
But, perhaps that is better for ME after all,
For if I get attention, 'twill not in a squall
Which will stop ME from growing,
and THAT isn't all—
The voters will clamor to cut down
MY size,
So let the Twins 'take it'—till people
get wise."
Comparative size of Budget Items based on actual figures from U. S. Census Bureau, United States News and other reliable sources.
TAXES
FOOD
CLOTHING
RENT
I'M GAS
I'M ELECTRICITY

Recent Window Display of Rochester Gas & Electric Co., Rochester, N. Y. The "Tiny Twins of the Budget Family" idea is being used in advertisements, radio programs and other publicity of the company.

"SUCCESSFUL SELLING"

A Novel Water Heating Campaign

By J. E. BULLARD

THERE is good reason to believe that more water for domestic use is being heated in kettles on the kitchen range than in all other ways combined. It was the conviction that this is the case which germinated the idea growing into the novel water heating campaign that is being conducted by the Pawtucket (R. I.) Gas Company.

Data available indicates that the average gas company is selling gas for water heating to a relatively small percentage of homes on its mains. Naturally, water is heated with coal and with oil but in the homes occupied by those with the smallest incomes there is still a high percentage of residences in which there is no hot water piping at all.

Last spring, the Pawtucket Gas Company made a survey of its territory and discovered that about two-thirds of its domestic customers were getting along without hot water service. This percentage offered a wonderful field for development. Aside from the immediate gas sales returns which could be expected there was the tremendous educational value of getting these people accustomed to heating water with gas

It was borne in mind that soon some of these low income customers might be enjoying much larger returns for their efforts and would be in a position where they could afford full water heating service. If they know about gas heating, if they are thoroughly familiar with it, then it becomes much easier to sell them gas. If they know nothing about it, if they have had no experience with it then it is not so easy to convince them that gas is the ideal fuel for water heating.

There is a rather general impression among householders that where there is a hot water back in a coal range, a hot water bottle connected to a steam boiler, a coil in a warm air furnace or other means of heating water with fuel that is used for other purposes, then it costs nothing to heat the water. Since in all these cases the heat that goes into the water is taken directly from the burning fuel and is in no sense waste heat, it is obvious that the water heating does cost money, that more fuel is actually burned when the water is being heated than would be the case if there was no water heating. However, it is not an easy matter to show the householder how much it is costing him.

Junior Water Heater Installed

The easiest way to solve the problem is certainly to make gas just as popular as possible as a fuel for heating water and one way of doing this is to get just as many people as possible using gas. In the case of the low income customers, the Pawtucket Gas Company found there was no appliance on the market that exactly met the requirements. The heater needed would have to be one of low first cost so that the maximum number of low income customers could afford to buy it. The cost of operation would also have to be low.

Conferences with manufacturers finally resulted in the heater which was used. This is an instantaneous heater consuming 60 cubic feet of gas an hour and heating water at the rate of a half gallon a minute. It is designed primarily for installation at the kitchen sink because it is here where there are the most frequent requirements for hot water and where the quantity required at any one time is ordinarily small. The installation is simple. It is merely a matter of making a gas connection and a water connection from a tee placed in the cold water pipe. The heater itself is usually installed directly above or to one side of the sink with the water flowing directly from the heater to the sink. There are practically no radiation losses and there is no waiting for hot water as the distance from where it is heated to where it is used is a matter of inches rather than feet.

The heater is manually controlled. The water cannot be turned on till the pilot is turned on. The water and the gas valve are operated by the same lever. It is made as fool proof as it appears possible to make it. The pilot flame may be left burning all the time or turned off when hot water is not needed. Putting the heater in operation is merely a matter of turning on the pilot, lighting it and then turning on the water.

With this heater to sell, the following sales plan was developed. The cash price, including installation was set at $29.50. Terms net, one dollar down and one dollar a month for a period to cover the cash price plus the carrying charge that would have to be added. In order, however, to install as many of these heaters as possible at the very start a 60 days' campaign for May and June was planned on the basis of rental. The heaters were installed free and a year's trial given at 25 cents a month. The consumer agreed that at the end of the year, the gas company would be allowed to remove the heater and retain the $3.00 paid as rental or the consumer would purchase it, the $3.00 already paid applying to the purchase price and the balance being paid either in monthly installment of a dollar a month or in cash in full.

It was estimated that this campaign would result in the installation of some 300 or 400 heaters. When the two months were past and the figures were totaled up, it was found

that over 600 had been installed. Out of this 600 there were only two where the consumer had come to believe that more could be expected of them than could be realized. These two were removed. The rest of them remained in service which surely is a remarkable record for something entirely new like this little water heater.

Since the campaign was over and advertising and sales effort have not been directed so strenuously toward the heaters, they have continued to be installed with the result that by the middle of September somewhat over 700 were in use. This record has been made in spite of the fact that, at the start, the supply of heaters from the manufacturer was not sufficient to meet the demand, that in some cases, in old buildings, the water pressure was so low that the heaters could not safely be installed and in still others not enough room could be found at the kitchen sink to install them.

Increased Sale of Other Heaters

It has been found that the pushing of these heaters has also helped to increase the sale of regular water heating service. In other words it has stimulated interest in all gas water heating.

The limitations of these heaters have been impressed upon those who have had them installed. They have been told that the heater is designed for heating water where only limited quantities are required, such as for dish washing, small washings consisting of just a few pieces and other work done at the kitchen sink. Yet users have shown their ingenuity in various ways.

One woman told how she moved her washing machine up to the sink, attached a rubber hose to the water outlet of the heater, turned on the the gas and let the water run. It took time and the water was not quite hot enough but she only had to use one tea kettle full of boiling water to bring the temperature up to the desired point. She did not have to heat water in a number of kettles on the range as she had had to do before.

Where a bath is desired some people have used the same idea to heat the water for the bath. If it is not hot enough when the tub is as full as desired, then water heated to the boiling point on the range is added.

Cases like this, which are constantly coming to the attention of the gas company, indicate the enthusiasm of those who are using the heater. All this time, these users are learning how convenient and economical the gas water heater is.

It is too soon to determine with any degree of accuracy just what effect the use of these heaters will have on the gas consumption. As a matter of fact, the increase in the gas consumption is probably not as important as the fact that this use of gas is serving as an entering wedge toward a more extensive use of gas for water heating.

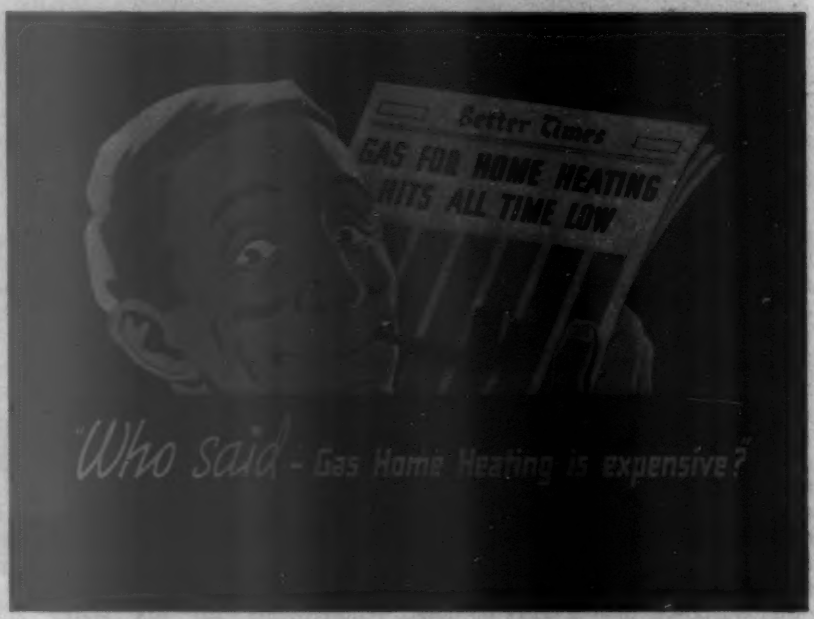
There is no losing sight of the fact that many a person who has bought a new automobile this year started with a used car some years ago which he bought at a very low price. The possession of that car got him accustomed to the use of an automobile and gradually he bought a better and a better car until he now owns a new one.

There is much evidence to indicate that the sale of these little water heaters will open the way for a much wider use of gas for general water heating. After all, hot plates and small cookers were sold for a number of years before the modern gas range was sold to any degree. Small, portable space heaters were sold for a long time before anyone thought seriously of heating an entire home with manufactured gas. People had to get accustomed to these uses of gas by using small appliances before they were willing to spend the money for the larger, more expensive and serviceable appliances. The Pawtucket Gas Company has demonstrated, at least to its own satisfaction, that history will repeat itself in regard to water heating. These little water heaters make it possible for most of the homes in any community to have gas water heating in a limited way. Once these people get accustomed to heating water with gas, they will want to heat all the water with gas. The desire having been created, it is only a matter of securing a sufficiently large income to satisfy that desire and there are millions of car owners who have demonstrated to what magical extent the budget of a limited income can be stretched to include what is greatly desired.

Sales Ideas

Out in the north-west the gas men who are going after load are using a plan to sell circulating type heaters that should be of interest to men in other sections of the country. These fellows sell a heater price $50.00 installed on a basis of 2% per month with no down payment.

Another company in the middle west have made a drive on oil burner users to sell gas conversion jobs. This company has built up a list of folks who use oil in their furnaces and not only do they bombard them with mailings every two weeks but they make personal calls. It's just a matter of planning your work and working your plan—this matter of selling.

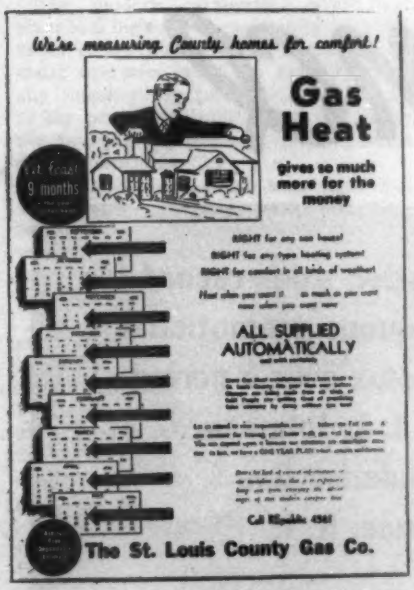


An Effective Window Display by Consolidated Gas Company of New York

The Colonel's Commentary

By Wm. H. Matlack

These chilly Fall mornings and evenings make a fella wish for a little heat—you know the kind that would not call for furnace poking and coal heaving. Too, a fella gets an idea that gas heat is well worth considering when he reads about "Measured Heat for your Home."—"Firing with your


We're measuring County homes for comfort!
Gas Heat
gives so much more for the money
ALL SUPPLIED AUTOMATICALLY
The St. Louis County Gas Co.

fingertip," and all those convenient ways when you use gas. And again, it makes a fella think again when he picks up the morning paper and reads about the new gas circulating heaters for Office, Shop and Home.

Circulating
GAS HEATERS
for office • store • home
Keep Comfortable in Your Office
Don't Let Your Customers Get Cold
Keep the Family Healthy and Happy
GAS CIRCULATING HEATERS FOR HEATING ONE OR MORE ROOMS PRICED AS LOW AS $16.50
sold by
Associated Hardware Dealers
and
THE LACLEDE GAS LIGHT COMPANY

Those new gas arc lamps are certainly making the oil stations here and there the brightest spots in the city—commercial lighting with gas it would seem has found its sea-legs.

We've heard, and we heaved a sigh, that some of the boys are not having all range installations followed up by a home economist. One fella said the reason was to save money. That's a mistake, every range should be followed up by an Economist—no matter if it goes into the home of a grandmother who has used gas for cooking for ages—there's always a new kink that these home service girls can give her and which helps mightily to keep gas cookery sold. Dispensing with the services of a Home Economist is bad business, if you ask me.

"Morning Cooking Schools draw big crowds of interested housewives. This is especially true during the Fall months," said a Home Economist who has spent about fifteen years conducting Schools and studying results. This may be a hint to you men who are planning to stage a School this Fall.

MERCHANDISE
Coal, Coke and Fuel 56

TRY
GAS HEAT
AT OUR EXPENSE

We will install a gas burner in your home at our expense—remove it at our expense, if you are not satisfied with it—and you pay only

$2.95 Per Month Rent
(During the heating season)

Illinois Power and Light Corp.

Clever we calls it, because it gets results. Look at this little want ad run in the classified section of Sunday and Wednesday newspapers—every one of them, so we are told, brought many inquiries—maybe it would pay some of you fellows to try it, not only to develop loads for home heating, but gas cookery and water heating jobs.

Many gas companies are going after the portable gas heater business this year. Many of the plans are of the rental type—with no down-payment, while others are on a straight sales plan with a very low payment and easy monthly payments spread over a long period. Load building is the vogue, the salvation of the Gas Company, and we sure are glad to see the boys getting active along this line.

We like that idea that one of the Southern Companies had for bringing a sales drive to a successful culmination by designating the final or wind-up day of the activity as "Presidents Day."—naturally the incentive offered for sales closed on that final day was a boosted bonus—which after all, call 'em what you may, it's "the what-do-I-get-out-of-it" that puts the sales force on it's toes and produces results.

ELECTROLUX NOW OUTSELLS ALL OTHER REFRIGERATORS IN *Providence*

This outstanding gas refrigeration sales record for 1935 is the result of "continuous promotional and selling effort on Electrolux over a period of several years," says J. L. Johnson, Sales Manager, Providence Gas Company, Providence, R. I.

USES NO WATER

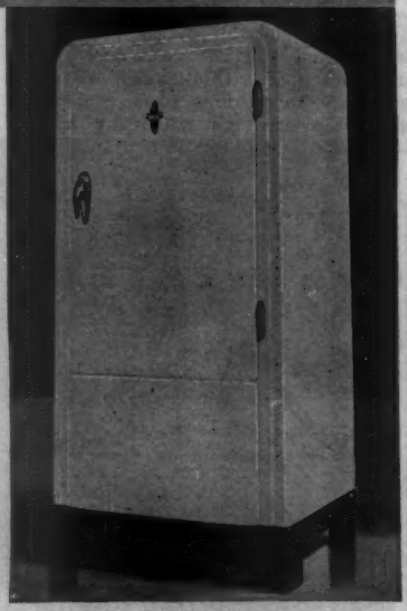
PROVIDENCE gas men are proud of the job they are doing with gas refrigeration! And rightly so! Their aggressive and consistent activity has put Electrolux in first place for automatic refrigerator sales in Providence this year!

Mr. Johnson, sales manager of the Providence Gas Co., finds it difficult to attribute his company's success to any one factor alone. Rather, it was the combination of an enthusiastic sales staff, employee co-operation, fullest managerial support, the sales efforts of dealers, continuous advertising, and payment plans in keeping with the trend in current merchandising.

However, says Mr. Johnson, none of these factors could have achieved the results obtained "if it were not for the fact that the gas refrigerator is superior to any other refrigerator on the market, which in turn has made possible this happy situation: The Trend is Definitely to Gas Refrigeration."

The experience of the Providence Gas Company is becoming increasingly the experience of gas companies the country over. Each year, more and more gas companies are putting the full strength of their organization behind the merchandising and selling of gas refrigeration. And each year, more and more families are discovering that no other refrigerator can match all the important advantages which Electrolux offers. Today, in more than half a million modern American homes, Electrolux is serving faithfully . . . building good-will and increased load for gas companies . . . publicizing gas as the modern fuel.

For assistance in planning your fall and winter Electrolux campaigns, write, wire or phone, Servel, Inc., Electrolux Refrigerator Sales Division, Evansville, Indiana.



NEW *Air-Cooled*
ELECTROLUX
THE SERVEL *Gas* REFRIGERATOR

Improved Equipment & Appliance Section

In this Section will be found illustrations and descriptions of new and improved gas plant and distribution equipment, domestic and industrial appliances and accessories

U. G. I. Products and Service

The modern carburetted water gas plant is a high-grade engineering achievement, comparable in efficiency and automatic operation with the best plants in any industry. By reason of the nature of the process it fulfills most completely the exacting requirements of the present day gas business.

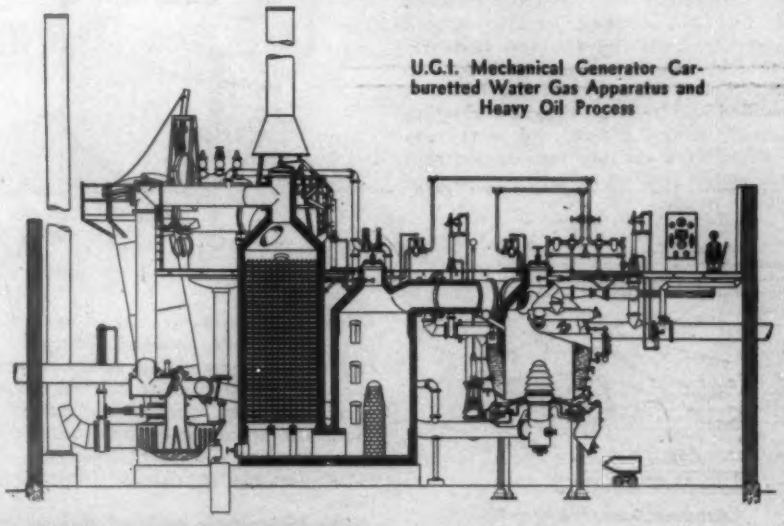
Of all processes which supply gas that will comply with public standards, Carburetted Water Gas requires the lowest investment, smallest labor organization and lowest conversion cost and possesses the highest capacity, greatest flexibility.

The U. G. I. self-clinkering generator and automatically controlled Carburetted Water Gas Sets give high capacities and high efficiencies. The use of U. G. I. Processes makes possible the use of the most economical materials available in the particular locality be they bituminous coal, coke, gas oil, heavy oils or refinery gas.

U. G. I. Waste Heat Boiler utilizes this sensible heat of the blast gases from the set to provide steam for the plant, and the Steam Accumulator makes possible the use of the maximum amount of exhaust steam to displace the high pressure steam used for the water gas process.

U. G. I. Coal Gas Apparatus

The U. G. I. Vertical Chamber Oven provides coal gas production equipment which meets the economic conditions existing in the country today. They require the sale of the minimum amount of coke to supply the output of gas, and produce the quality of coke suitable for domestic and similar uses. With little reduction in efficiency the gas output of the chamber oven can be varied from day to day to meet the load curve of the average company's output.



U.G.I. Mechanical Generator Carburetted Water Gas Apparatus and Heavy Oil Process

U.G.I. Mechanical Generator

U.G.I. Vertical Chamber Ovens

U. G. I. Gas Handling

U. G. I. High Duty Condensers, Tar Extraction Equipment, Naphthalene Scrubbers, Purifiers and Super Cooling Apparatus give the thorough conditioning of the gas so necessary for the modern appliance.

Gas Main and Pipe Line

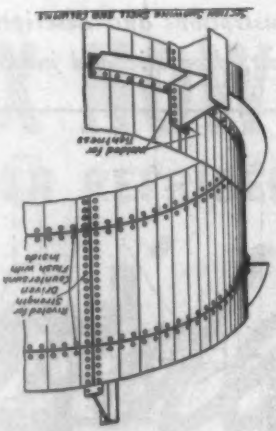
U. G. I. engineers have specialized in the design and construction of gas distribution systems, main extensions and pipe lines of all sizes. This large engineering staff is also available for consulting service on problems that arise when natural gas is introduced in any situation. U. G. I. also maintains a well equipped and efficient construction organization that is especially experienced in pipe line construction along highways and through congested districts.

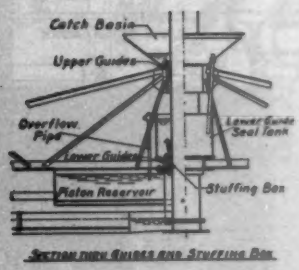
U. G. I. products not mentioned before, but supplied by U. G. I. are Blue Gas and Hydrogen Plants, Automatic Chargers, Coke Producers, Cottrell Electrical Tar Precipitators, Cyclonic Dust Catchers, Pier Process for bituminous coal use, Scroll Tar Separator and many specialties.

Complete information and data on any phase of U. G. I. Equipment and service will be forwarded on request to United Engineers and Constructors, Inc., Philadelphia, Penna.

The New B. H. Co. Waterless Gas Holder

A recent development which embodies all the proved, recognized and established features of reliable, safe and permanent operation. This new type holder, manufactured by the Bartlett Hayward Co., Baltimore, Md., consists of a cylindrical shell properly stiffened by vertical columns equally spaced about the circumference and regularly spaced horizontal stiffener galleries circumscribing the shell, within which is provided a free moving or floating uniquely guided piston, and at the top of which is a suitably constructed roof with ample ventilating facilities to protect the inside.



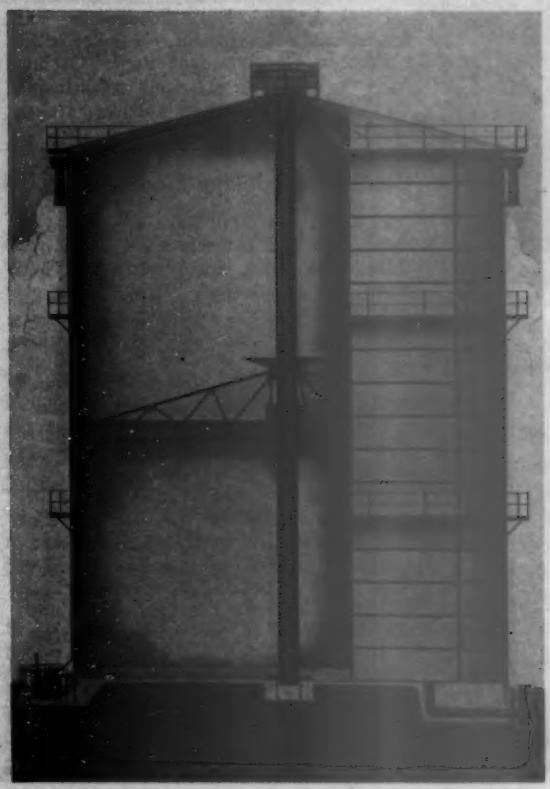


Section Thru Guides and Stuffing Box

The piston guiding is accomplished in a very unique yet simple and practical manner by means of a vertical tubular steel post, located at the axis of the cylindrical shell. This post, passing through the center of a rigidly trussed and steel plate piston, extends from the holder bottom upon which it is supported up to the apex of the roof. It facilitates adequate and generous guiding for the piston in its vertical motion, permitting free circular movement of the piston about the common axis, without restraint, whenever demanded, due to temperature changes or other conditions.

The hydrostatic seal, of uniform and ample depth—security against gas losses—at the periphery of the piston embodies the same, in fact identical features of design and construction employed in the largest M. A. N. holders.

There is no manual lubrication necessary on the piston since it is free of all moving parts or rollers.



Cross Section B. H. Co. Waterless Gas Holder

Safety Check Valves

B. H. Co. Safety Check Valves for exhausters and boosters, another product of the Bartlett Hayward Co., eliminate the hazards due to a reversal of flow of gas at exhausters or boosters in event of unforeseen shutdowns. They further facilitate the starting up and shutting down of these units.

Ball bearings and lubricated packing assure operation at low differential pressures.

Designed to prevent chattering even with position exhauster operating at low speed.

The Multi-Seal Rivet

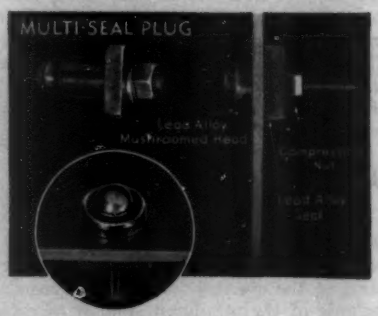
The Multi-Seal Rivet, manufactured by the Multi-Seal Manufacturing Company, Chicago, Illinois, is a substantial rivet which produces a triple seal in holes and other openings, through the compression and expansion of the metal in its outer jacket. It is the development of years of research by companies and their engineers who were anxious to solve once and for all, the problem of making rapid repairs without tying up production by having to stop operation.

It consists of five essential parts:

(1) A sturdy center bolt of steel.

(2) A soft metal jacket, molded of special alloy with square head.

(3) A hard brass compression ferrule set in under the head of the bolt and extending over the end of the metal jacket.



(4) A square steel washer conforming in size to the square head of the metal jacket.

(5) A nut, fitted to the steel bolt securing the entire essembly.

The action of the Multi-Seal Rivet is as follows: Drill or ream the opening just large enough to permit the insertion of the proper size Multi-Seal Rivet.

Holding the square head of the jacket, with Multi-Fit wrench or pliers, draw up the hex nut until tight.

As the nut is drawn up, the special alloy jacket expands, forming a head on the opposite side. At the same time, the forming metal fills and seals cracks and irregular holes perfectly.

In the drawing up process, the compression ferrule expands and flattens so that the head on the opposite side is actually formed by the combination of the alloy with the sheet brass, providing tremendous strength.

WATERLESS GAS HOLDERS
Built By
The BARTLETT HAYWARD Co.
in the
CHICAGO DISTRICT

By-Product Coke Corp., So. Chicago
North Shore Gas Co., Deerfield
No. Indiana Gas & Electric, Michigan City
Peoples Gas Light and Coke Co., North Shore; Division St.; Calumet Sta.; 73rd St.
Public Service Co. of Northern Illinois, Maywood; Blue Island
Wisconsin Steel Co., So. Chicago
Youngstown Sheet & Tube, So. Chicago

82 MILLION CU. FT. IN CHICAGO

More than 314,000,000 cubic feet throughout the United States or approximately 22% of all Gas Holder capacity now in service in this country.

These figures are evidence of the advantages and operating economies of the WATERLESS GAS HOLDERS constructed by—

THE BARTLETT HAYWARD COMPANY

Baltimore, Maryland

Engineers, Manufacturers and Constructors

of Complete Gas Plants—Coal, Carburetted Water, Blue Water and Oil—Gas Manufacturing and By-Products Apparatus—Gas Holders, Dry and Water Seal Types—Steel Mill Equipment, Blast Furnace Scrubbers (Feld Type), Hot Metal Cars (Pugh Ladle), Goggle Valves (Westling Type)—Power Transmission Equipment, Fast's Self-Aligning Couplings—Tanks—Plate Works—Special Machinery—Piston Rings (American Hammered).

FOUNDED 1832

COMPOSITE VIEW OF THE MOST MODERN AND BEST EQUIPPED METER, REGULATOR, AND VALVE FACTORIES IN THE WORLD.

It is the duty of every employee to keep the Quality of

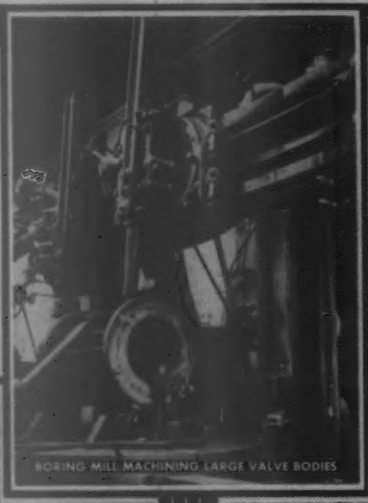
EMCO & NORDSTROM PRODUCTS

up to the High Standard that has established their reputation as the STANDARD of COMPARISON

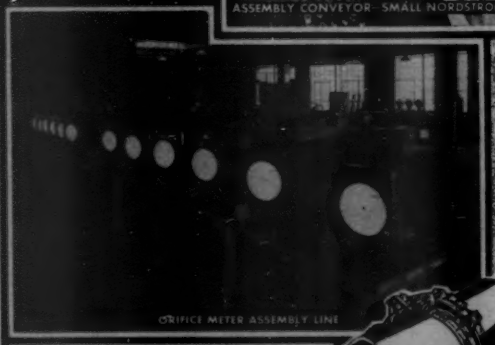
...PERATIONS ON SEMI-AUTOMATICS IN OAKLAND FACTORY

ASSEMBLY CONVEYOR - SMALL NORDSTROM VA...

GENERAL VIEW PROVING ROOM



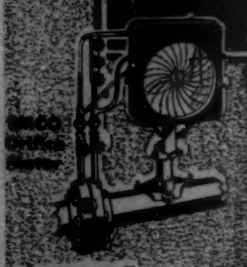
BORING MILL MACHINING LARGE VALVE BODIES



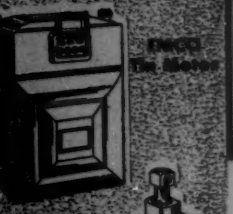
ORIFICE METER ASSEMBLY LINE

MACHINING LARGE METER AND REGULATOR CASTINGS

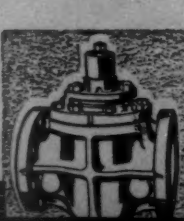
SECTION OF TIN METER DEPT.



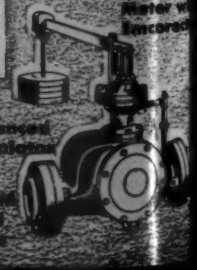
EMCO Type "B" Ejector Service Regulator



EMCO Standard Domestic Meter



EMCO Balanced Valve Regulator



NORDSTROM Lubricated Plug Valve

PITTSBURGH EQUITABLE METER CO.
MERCO NORDSTROM VALVE CO.

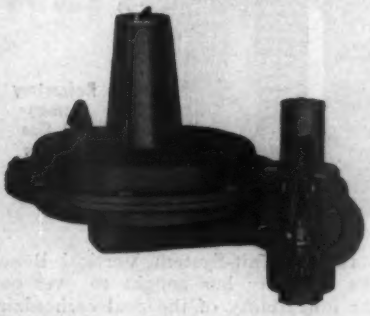
MAIN OFFICES PITTSBURGH, PA.

MEMPHIS	HOUSTON	TULSA
ATLANTA	PHILADELPHIA	CHICAGO
NEW YORK	LOS ANGELES	BUFFALO
COLUMBIA	KANSAS CITY	OAKLAND

Improved Pittsburgh Equitable Meter Co., Products

Emco Type B Ejector Service Regulator

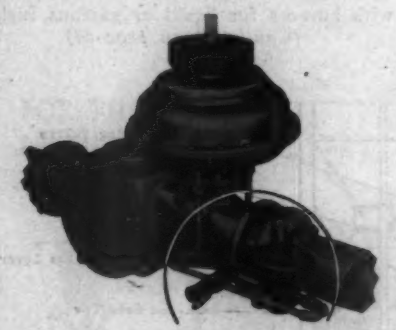
The EMCO Type B Ejector Service Regulator gives effective automatic loading by streamline flow of gas through the valve and valve seat, provides low shut-off by the development



of the Emcomold Valve and makes possible increased capacity through improved diaghragm spring design. Any existing EMCO Type B Service Regulator can be converted into the Ejector type by the addition of a few small parts. Made in both spring and weight types in ¾", 1", 1¼", 1½" and 2" sizes.

Emcoloader

In many of the older distribution systems the increased use of gas causes pressure difficulties, particularly when peak loads are encountered. To remedy such conditions the Pittsburgh Equitable Meter Company has developed the



EMCOLOADER, which, when used in conjunction with any low pressure district regulator, will increase the outlet pressure in proportion to the volume, thereby eliminating peak load pressure troubles.

Emco Large Capacity Pressed Steel Meters

EMCO Pressed Steel Meters are available in two sizes for measuring maximum volumes of 6000 and 10,000 cu. ft. per hour respectively, with a pressure drop of less than 2" of water. Welded Pressed Steel Construction permits a meter of large capacity which occupies a minimum of space. Types for both manufactured and natural gas.

Emco Large Capacity No. 4½ Meter with Type I Emcorector

The Emcorector

The Emcorector is designed and built to make high pressure positive meters direct reading. It replaces the conventional pressure and volume gauge as generally used on high pressure meters. It gives a direct reading of volume corrected to any base pressure, regardless of line pressure fluctuations. This eliminates the time and expense involved in making chart calculations. The correction is made automatically on small increments. The Emcorector can be furnished for use on any high pressure gas meter. The Type I Emcorector is illustrated above.

Emco Safety-Seal Pressure Regulator

The EMCO Safety-Seal Pressure Regulator has been developed to provide controlled burner pressure plus safe operation without the necessity of running a vent line. The regulator is so constructed that in the event of control diaphragm leakage or failure, a second diaphragm is actuated which

speedily prevents the non-vented gas from escaping to atmosphere and also causes the main gas flow through the regulator to be retarded to such a point that the Klixon valve in the burner will no longer remain open, thereby shutting off the flow and indicating excessive diaphragm leakage.

Emco-Nordstrom Lubricated Plug Valves

These valves have standard gate valve face to face dimensions and embody all the advantages inherent to the general Nordstrom line, including the patented "Sealdport" method of lubri-

cation and plug lifting features that make operation easy and positive at all times It is now economical to replace valves of other types with these lubricated plug valves since they can be installed without altering existing pipe dimensions.

Emco Bell Joint Clamps

This clamp is designed for one purpose—to stop leakage at the joints in existing cast iron bell and spigot pipe. Sectional construction permits application to the joints without disturbing the line.

Emco Flow Indicating Meter

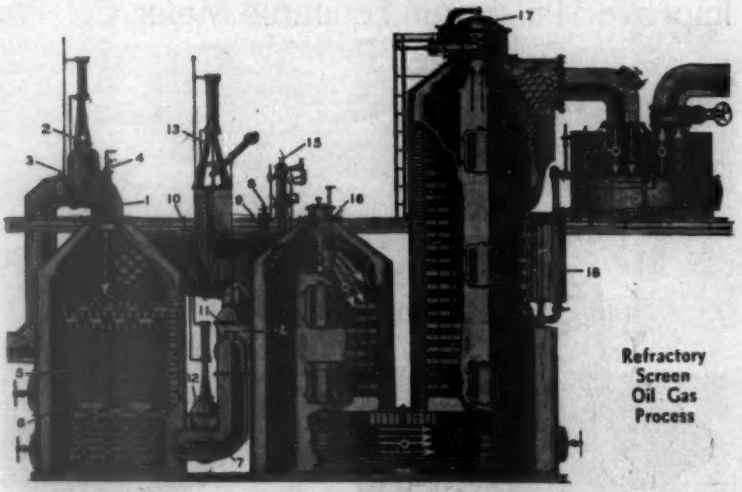
The EMCO Flow Indicating Meter is indispensable for such services as setting Servel Electrolux Refrigerators, adjusting pilot lights, studying leakage, etc. It shows the rate of flow in cubic feet per hour on a direct reading scale instantly and accurately. Due to its small size and light weight, the EMCO Flow Meter is particularly adaptable for service and installation work.

All these products are manufactured by the Pittsburgh Equitable Meter Co., Pittsburgh, Pa.

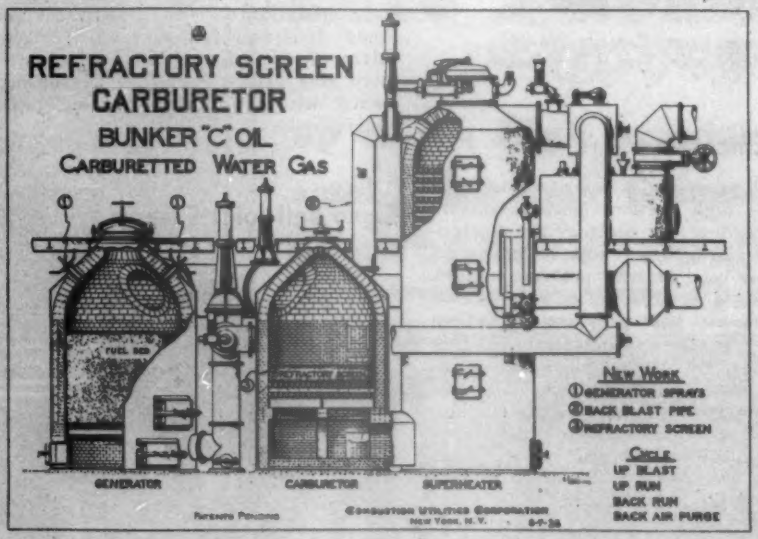
New Developments of Improved Equipment-Russell Engineering Corporation

For the past few years the Improved Equipment-Russell Engineering Corpn., N. Y., has cooperated with the Combustion Utilities Corporation in the development of new gas manufacturing processes. The result of this cooperative work to date is the Refractory Screen Carburetor.

The Refractory Screen Oil Gas Process is for the manufacture of high B.t.u. gas and provides standby and peak load service in natural gas situations. The burning characteristics, specific gravity and B.t.u. value of the gas produced, so closely resemble natural gas that it can be substituted for, or mixed with natural gas and necessitating a minimum of burner adjustments.



Refractory Screen Oil Gas Process



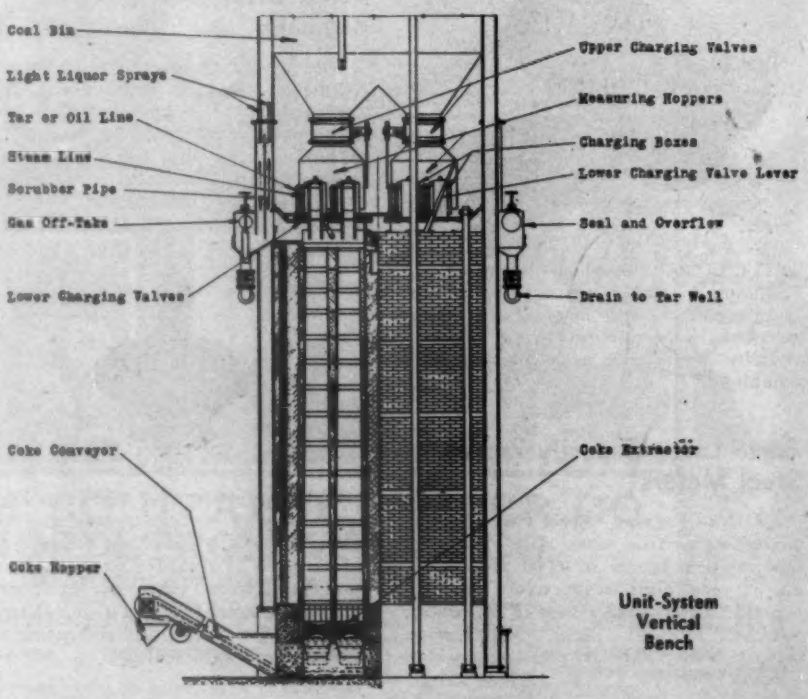
In the Unit-System Vertical Bench, the company has sought to overcome the inflexibility of the coal carbonizing process and to provide a type of apparatus capable of a wider gas production range, quickly available standby capacity and a more controlled variation in the ratio of coke to gas produced.

The recently patented Unit-System Vertical Bench consists generally of a masonry block having four vertical combustion chambers. Each chamber contains a tall and relatively narrow retort thru which coal passes downward in a thin, broad stream between two highly heated surfaces. Horizontal flues at the sides of the lower end of each retort form coke cooling zones and preheaters for combustion air. Heating flues on each side of the upper two-thirds of the retort are equipped with burners for liquid or gaseous fuel,

(Continued on page 60)

The Refractory Screen Carburetor Process is for the production of a 500-550 B.t.u. gas having the identical characteristics of carburetted water gas. Oil and solid fuels are used in this process and the proportions of these fuels can be so regulated and varied to take advantage of any price differential between Bunker "C" and higher grade oils or, between oils and solid fuels. Existing standard carburetted water gas sets can be equipped with either process.

Along with these other developments, the Improved Equipment-Russell Engineering Corporation has been continuing further development of apparatus in its original field of coal gas generating equipment, and during the past year has announced, among other items, the Unit-System Vertical Retort Bench and a Tar Gasification Chamber for use in underfiring coal gas benches.



Unit-System Vertical Bench

New Fuel Economy For the Manufactured Gas Industry

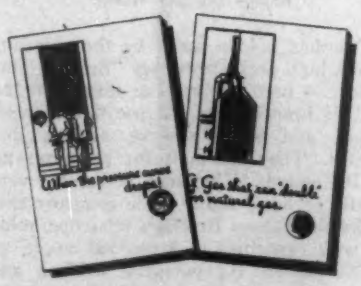
REFRACTORY SCREEN CARBURETION

In actual commercial operation, this process has demonstrated its ability to meet today's demand for a 500-550 BTU gas manufacturing process which will utilize low-cost fuels and will take advantage of fuel cost fluctuations.

The generator fuels used are coke and oil. The grade of oil used (Bunker "C" or residuum) and the proportion of oil to coke are determined by the relative cost of the various fuels.

The refractory screen in the carburetor makes practical the economic use of heavy, high-carbon oils in both generator and carburetor, because it retains and subsequently gasifies the carbon from these oils.

FOR THE NATURAL GAS INDUSTRY



These booklets will be sent on request.

"When the Pressure Curve Drops"
"A Gas That Can 'Double' for Natural Gas"

Like the Refractory Screen Oil Gas Process, which is also a development of Combustion Utilities Corporation, this process can be installed in standard carburetted water gas sets.

We will be pleased to make a survey of your plant and show you the economic and operating advantages the Refractory Screen Carburetor Process offers you.

Representatives of this company and of Combustion Utilities Corporation will attend the convention, and will be glad to discuss production problems with you.

Improved Equipment-Russell Engineering Corporation

24 State Street **New York, N. Y.**

(Continued from page 58)

i. e., oil, tar, producer gas, holder gas, or raw gas from the foul main. There is no fuel-gas producer attached to the unit.

Retorts may be operated on any desired schedule, — continuous, intermittent, long or short burns. Being valve controlled, fuel input may be adjusted to meet immediate requirements, and as each retort is provided with an independent heating system, any retort may be operated as a separate unit on any schedule best adapted to demand and to the grade of coal and without influencing the operation of other retorts in the bench.

Process variations are available in the additional and simultaneous production of controlled amounts of blue gas, oil gas, etc., with coal gas.

The retorts may be operated so as to produce a minimum of coke, the reduced coal gas generation being compensated for by the production of oil or blue gas in the retorts. Production of this auxiliary gas is accomplished by a new method provided in the system.

If the demand for coke is in excess of the normal "coke to gas" production ratio, the bench may be operated at its full coal carbonizing capacity and raw gas drawn from the foul main for use as fuel.

A few advantages of the Unit-System Vertical Retort Bench are: Production of straight coal or mixed gas; Provides for peak loads; Generates own steam; Delivers quenched, dustless, higher quality coke; Less operating labor; No bottom mouthpieces used; No producer, no clinkers, no ashes, no fireman. Production and investment costs are unusually low.

Vertical Retort and Carbonization Developments

The first commercial installation of Glover-West Vertical Retorts was put into operation in 1908. This plant was connected with an independent auxiliary plant so that accurate tests could be made of the behavior of coal in continuous vertical retorts and the results obtained under practical working conditions. Practically all the typical varieties of gas coal from all parts of the world were carbonized in this plant. The published results of these tests form the first collection of data on the subject of continuous carbonization of coal on a practical scale.

The second installation, built in 1910, also was tested on different classes of coals and the results made available to the industry.

It was at this time that the practice of "steaming" was more generally adopted. The Glover-West system of zoning the carbonizing heats lent itself admirably to this development.

Design of the Retort

The three principal points embodied in their design are—

(1) The possibility of varying the temperature of the retort at any point in its length and to any required degree to suit the physical characteristics of the material being carbonized.

(2) The realization of the economy from the conservation and utilization of the available heat so that the losses are reduced to the minimum.

(3) The maximum production of gas of any required quality with the maximum of secondary products.

The Westvertical System of Intermittent Carbonization provides a new and unique method of coal carbonization. The object is to produce, for certain markets, a strong, even-textured coke; and, at the same time improving the gas yield without sacrificing the advantages of continuous carbonization.

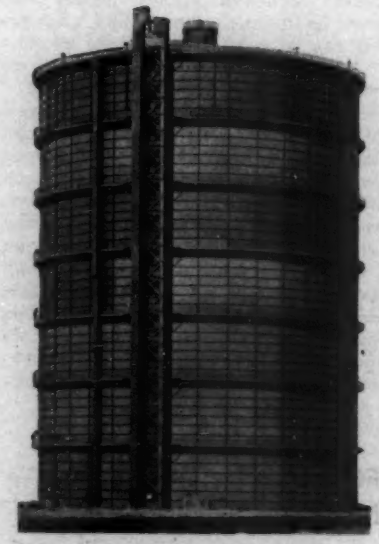
The system comprises: a vertical carbonizing chamber, generally similar to the continuous vertical retort, built above a coke cooling chamber with an intermediate zone between the two. The lower part of the cooling chamber forms the coke discharge chamber which is emptied to discharge the cooled coke. The intermediate zone is always full of hot coke in which the manufacture of water gas is proceeding continuously during the entire period of carbonization. Coal is fed into the top of the chamber as soon as coke has been discharged from the bottom.

In operation: there is complete freedom from high pressures at the base of the chamber, thus avoiding necessity for bottom gas offtakes; no initial change of breeze demanded; continuous steaming; coke discharged cool and dry; constant quality coke throughout—no "tops" and "bottoms"; fluctuating gas demands met by simple adjustment; small hourly B.T.U. variation; coke discharged cold.

The method of heating the chambers, the elliptical shape of the chamber proper, and the materials used—all generally similar to those in Glover-West Continuous Vertical Retorts.

Complete Line of Gas Holders

Stacey Brothers Gas Construction Co., Cincinnati, O., are the exclusive licensees for the United States of the Stacey-Klonne Dry Seal Gas Holder. It is a waterless holder that utilizes a unique mechanical seal not dependent on a uniform depth of sealing liquid. It consists of a stationary cylindrical steel shell with smooth interior surface within which a piston moves up and down, below which the gas is stored.



Klonne Dry Seal Holder

Stacey "Bullet"

Another holder made by the company is the high pressure Stacey "Bullet." This holder is used for reserve storage at the end of branch lines for use during peak loads, and as a reserve against line breaks. They are built for pressures up to 100 pounds. They may be erected vertically or horizontally. The company also make the Stacey Brothers telescope holder with capacities of from 500 cu. ft. to 15,000,000 cu ft., purifiers, drilling and pumping equipment.

Stacey Purifier

Modern Carbonizing Systems

GLOVER-WEST
CONTINUOUS VERTICAL RETORTS

The logical plant for maximum gas yield. In addition, the high thermal efficiency, low operating costs, extreme flexibility to meet changes in working conditions, kind of coal and demand for varying qualities of gas and varying loads make the adoption of Glover-West Vertical Retorts well worthy of consideration in any scheme of planning for the future.

WEST-VERTICAL
SEMI-INTERMITTENT VERTICALS

A modification of the continuous vertical that has been thoroughly tried out in our own research department and in actual gasworks operation.

The "West-vertical" retains the proved advantages of continuous carbonization such as low capital costs, high thermal yield, cool coke discharge, enclosed coal charging, and combines with them the best features of intermittent carbonization.

We place at your disposal the experience gained in over 355 installations.

Designed, Manufactured and Erected by

WEST GAS IMPROVEMENT COMPANY

Builders of Coal Gas Plants
424 Madison Avenue
New York, N. Y.

Gas Holder Inspection By Specialists Growing In Popularity

The past few years have brought to light new ways of increasing efficiency and holding down maintenance costs on plant equipment in the gas industry, states the Cruse-Kemper Co., Ambler, Pa. One of the most important innovations has been the growing use of periodical inspection on gas holders by highly specialized organizations outside of the gas company's own payroll. Naturally such work can best be accomplished by the firms trained in the building of gas holders, and so the Cruse-Kemper Company, together with others in the same field, have gradually found themselves with an added product on their list—this time a service and not a manufactured article.

The Cruse-Kemper service staff does not function only in connection with inspection of gas holders built by this organization, nor does it follow that this or any other company necessarily does the repair or replacement work in connection with such inspection tasks, if such work is required. It is rapidly becoming the practice to treat the inspection as an entirely separate and distinct operation. This makes for healthy competition in bidding on any job in the market.

This new development in the field has been received with general interest by the gas companies. Accurate inspection prolongs the life of any mechanical equipment and certainly adds to the service record of gas holders. Even small holders usually come under the heading of major plant costs, and the larger ones represent an investment of considerable sums of money. When the life of a holder can be prolonged several years the pro rata cost per year on this equipment is considerably lower.

Aside from the economy factor of holding down actual repair and replacement costs, inspection pays dividends to the gas company in the form of increased efficiency of holders on the job. A gas holder operating 100% is worth far more to its owner, day in and day out, than a holder requiring constant attention.

A further impetus has been given to this matter of inspection by the tightening up of State and Municipal regulations in connection with handling inspections. For example, the New York State Department of Public Service makes such requirements as the inspection of valves for holder connections at least twice a year. Atmosphere quality test is required weekly—and a daily measure of the depth of cup tar in alternate bays of waterless holders. Other states are rapidly making provisions requiring as constant attention to the holder condition as New York state now has in force.

Some gas companies have operated an inspection system by their own engineers, and such work has definite value. However, it is now appreciated that from time to time inspections by an outside source contribute advantages that "inside inspections," due partly to the effect of routine and familiarity, cannot achieve. Cruse-Kemper Company has on its staff a group of men trained, through years of experience, in every angle of gas holder manufacturing and operation. These men know gas holders intimately because they build gas holders. Coming in "cold," as they do, they are likely to see things which those in regular attendance overlook through familiarity.

On general section inspections and section carriages, for instance, the report calls for at least twenty separate inspections, such as "bottom rollers," "alignment of carriage frames," "radial roller spindles," "cup sediment," "intermediate sheets," etc. Each item is checked for general corrosion; corrosion of water line; paint condition; drainage; number of leaks, if any; safety and lubrication. A repair job based on this type of inspection results in a gas holder in perfect condition and capable of furnishing long service with little or no further maintenance cost.

Lux Material Used for Gas Purification Over 50 Years

Lux Material has been in the service of the gas industry for fifty years. The Alpha-Lux Company, 192 Front St., New York, since its inception has continuously striven to provide first, last, and at all times, a quality product. The company points out that if the costs in gas plants are scrutinized a small item for H_2S removal will be found. Notwithstanding its smallness on the cost sheet compared with expenses in other branches of operation, this small purification item, like the proverbial snowball, can grow to become a worrisome and expensive job if not properly handled.

Handles Rates of Flow

Some Gas plant men use Lux at all times because of the length of time it has been found to remain in the boxes. Other gas company engineers and superintendents have shown a preference for it, according to the Alpha-Lux Company, because it could handle rates of flow far above those previously considered possible. It efficiently purifies at temperatures considerably below normal.

High Absorption and Great Activity

Lux has not only a high sulphur absorption capacity, but also is extremely efficient on the removal of traces of H_2S.

Prof. Huff's Opinion

According to Professor Huff, of gas engineering at Johns Hopkins University, Baltimore, Md., iron oxide, ferric oxide or FE_2O_3 are worthless for the removal of hydrogen sulphide (H_2S). He says that in common with ordinary gas engineering the term "iron oxide" has been used, but the active material in the purification box is not "iron oxide" but "ferric hydroxide" or "ferric hydrate." The effect of moisture is very striking and particularly so in the revivification of the iron sulphide to form again the ferric hydrate. Some experiments have been made to ascertain the proper humidity necessary for complete revivification of the ferric hydroxide and they show that a sample exposed to air at 95% humidity completely revivified in five minutes whereas the sample exposed to humidity of 10% did not revivify until an hour and a half elapsed.

Lux is a "Ferric Hydroxide"

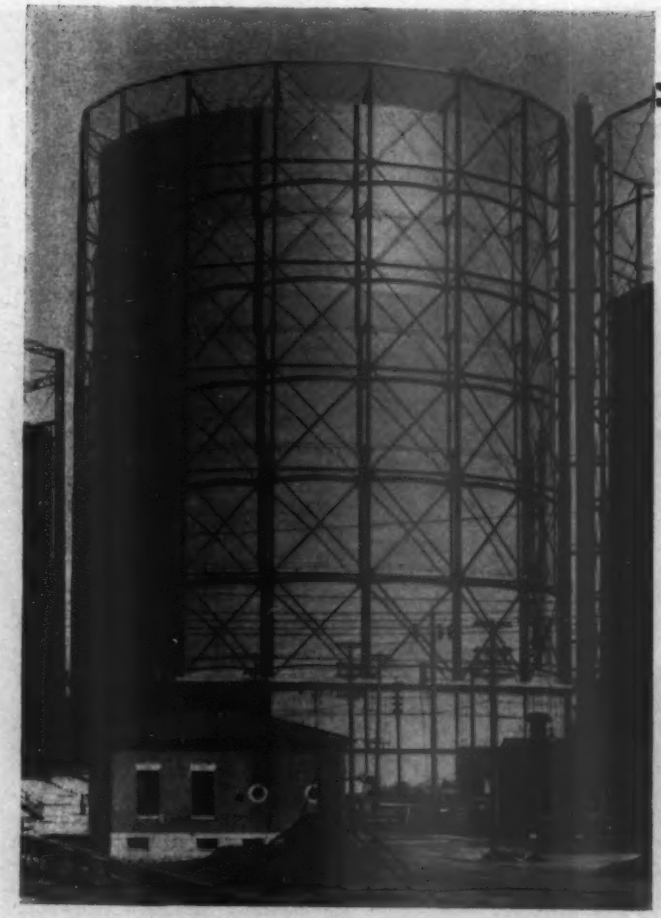
Lux is a ferric hydroxide and always runs uniform in its constituents, the manufacturers declare. Lux contains on a dry basis about 50% to 59% ferric hydrate. Furthermore, it is in a colloidal state, contains no free iron and may be stored indefinitely without heating up. Lux acts with full vigor, the company states, as soon as it is put in the boxes. It works equally well in the first application. It can be traversed by the gas at a higher velocity. Lux has a low specific weight. This advantage lies in less material by weight to be required to fill the purifying boxes and a much larger purifying surface, according to the Company, which adds that this is an important point in figuring the cost of sponge. Lux contains no dead weight like earth or fibre. The material is designed to purify in every particle. It is also stated that Lux requires fewer changes and will revivify quicker.

Vapor Phase Gum Control

Research during the past few years has demonstrated that the highly alkaline ferric hydroxide of LUX has a great affinity for NO, the base of Vapor Phase Gum. Therefore plants having this type of trouble are using LUX as the standard material for control of Vapor Phase Gum.

Dr. Ott-Lux-Gas-Tester

The Dr. Ott-Lux-Gas-Tester is simply constructed and easy to operate. It combines in one operation the information usually obtained by three manipulations: Gas analysis, specific gravity determination and calorimeter tests. While it is not designed to replace any of these three tests where specific results are required it will show any changes in gases which are caused by changes in composition, gravity or heating value.



Remember to have Cruse-Kemper build that Gas Holder and you can *Forget* maintenance and operating costs

THIS company provides, in full measure, the three qualities necessary for a job that gives equal satisfaction at the time of purchase . . . . and years afterwards.

First—Cruse-Kemper has had years of highly specialized experience in manufacturing major equipment for the Gas Industry. Second—Our Ambler plant offers complete, modern facilities to meet all needs. Third—In the development of methods and refinements in design, building and operation, we consistently maintain a leading position in the field.

GAS HOLDER INSPECTION

Utility companies have been quick to take advantage of this Cruse-Kemper service. It means money saved, time saved, repair and replacement saved. Our inspecting staff knows every detail of gas holder construction and its function. Write for our reasonable terms and complete inspection details.

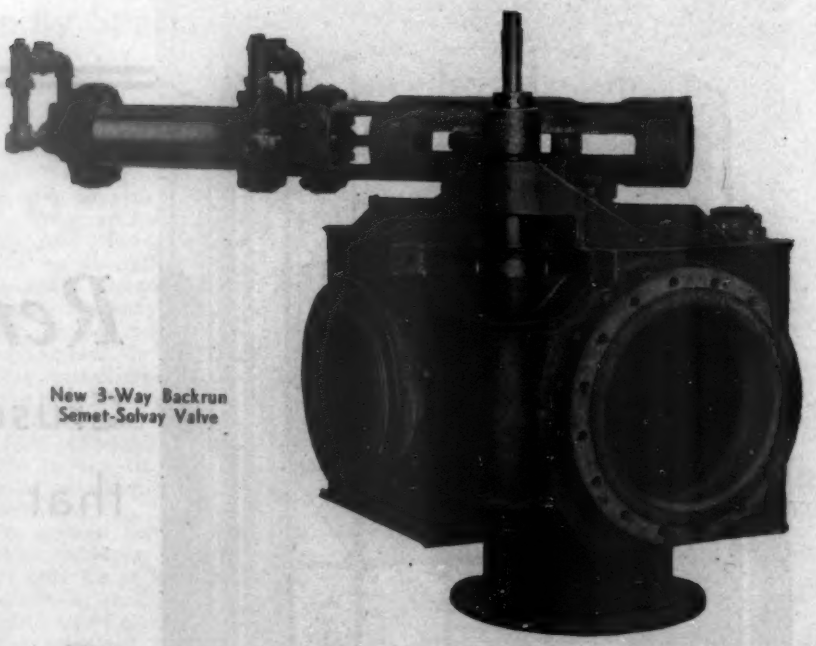
Cruse-Kemper Company

AMBLER PA.

New 3-Way Backrun Valve

Semet-Solvay Engineering Corp., 40 Rector St., New York, announce a new 3-Way Backrun Valve for water gas machines. It is designed to meet the more exacting demands that come with heavy oil carburetion.

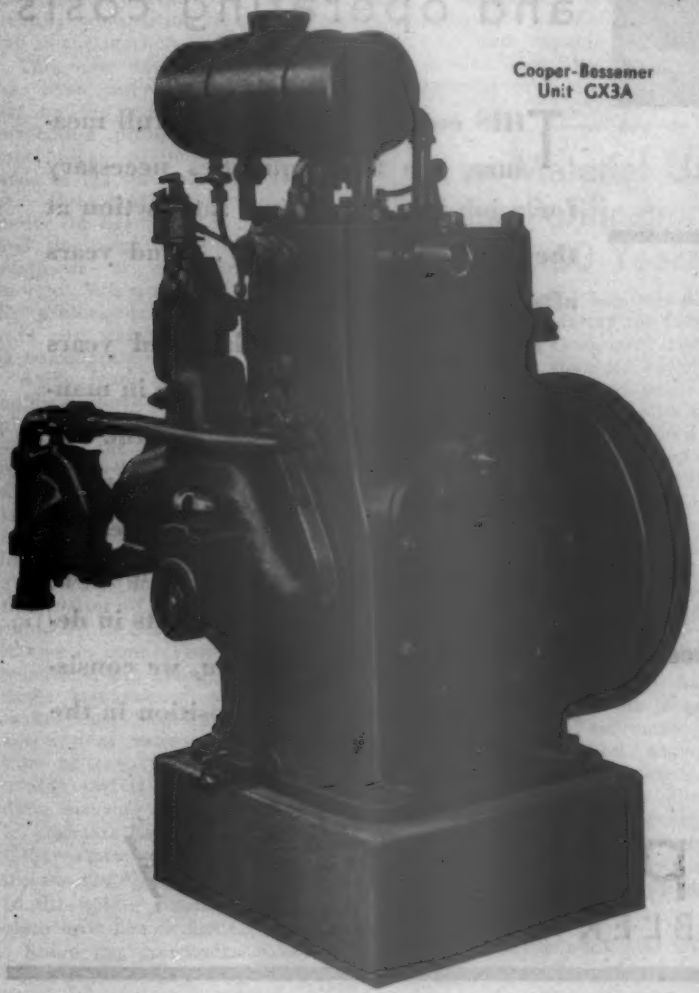
A quick opening door, full height of the box, allows easy access for inspection, cleaning, and replacement of any watering parts. It has dish welded steel discs, and disc seats are removable. It has two large bearings always in alignment, one above the box and the other partially outside, both cooled by radiation. An adequate spray system reduces carbon and tar accumulations when running on heavy oil. They are built for any size and type of water gas machine.



New 3-Way Backrun Semet-Solvay Valve

An Efficient Starting Unit For Gas and Diesel Engines

A new fast-working single-stage air compressor for starting gas and Diesel engines, capable of filling a tank of six cubic feet capacity up to 200 pounds pressure in five minutes or up to 250 pounds in nine and a half minutes, is now offered by The Cooper-Bessemer Corporation, Mt. Vernon, O. The efficiency of a small machine may be as important as that of a large one—if the larger depends on the smaller to set it in motion; and no satisfactory performance can be obtained from an ordinary small air compressor put into air-starting service. Such compressors, being designed for about 100 pounds pressure, as a rule, are naturally far from efficient at the higher pressures required for starting gas and Diesel engines.



Cooper-Bessemer Unit GX3A

Gas or Oil as Fuel

The new special Cooper-Bessemer unit, to be known as the GX3A, runs equally well on either gas or gasoline. It is a simple, self-contained combination engine and compressor. Ford parts are largely used, pistons, piston rings, connecting rods, connecting-rod bearings, engine valves, and many smaller parts being thus obtained, with the assurance of high quality and uniformity, at low cost.

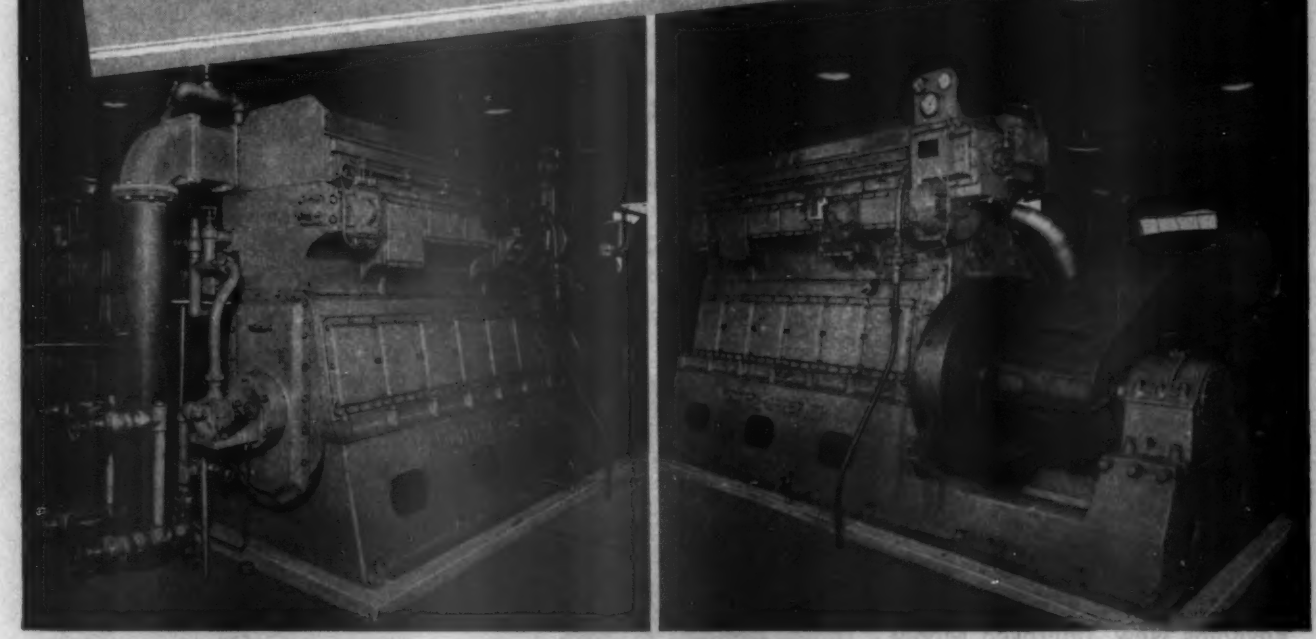
Both power and compressor cylinders, cast in one piece, are water-jacketed. The power-cylinder head, which is a separate casting, is of the automotive type, water-cooled, and carries a spark plug only. A Ford Model B gasoline carburetor and an adjustable gas mixing valve are furnished as standard equipment, also a rotary-type magneto with impulse coupling for hand starting.

Where gas is the fuel, it is possible to start the engine on gas; but the recommended procedure is to start on gasoline, then switch to gas. A one-gallon gasoline tank is mounted over the compressor and connected to the carburetor.

Splash lubrication is automatically provided for all parts. Oil reservoirs feed lubricant to the main bearings, valve tappets, camshaft bearings, governors, and magneto drive.

PROBLEM: How can GAS engines replace electric motors?

ANSWER: Here's how Birmingham Gas Company did it:



Two electric motors were lifted out. Right in on the same locations went two Cooper-Bessemer Type GN-6 gas engines. Nothing else was changed. The engines drive the same blowers as the motors they replaced. They operate at the same speed. Even the old chains and sprockets were retained. Your plant can be converted to gas power just as easily. It's good economy to use gas engines. Let a Cooper-Bessemer representative tell you more about it.

THE COOPER-BESSEMER CORPORATION

Mount Vernon, Ohio — PLANTS — Grove City, Pennsylvania

25 West 43rd St., New York City | Mills Bldg., Washington, D. C. | 840 East 61st St., Los Angeles, Calif. | Esperson Bldg., Houston, Texas | Magnolia Bldg., Dallas, Texas | 225 Crockett St., Shreveport, La. | 201 East First St., Tulsa, Oklahoma

Recent Developments in Gas Regulator Designs

Reynolds Low Pressure Small Volume Regulator with Automatic Shut-off Feature

This regulator is designed after the standard type of low pressure small volume regulator for gas refrigeration use, but has the added automatic feature of shutting off the gas in case the diaphragm ruptures, or if the gas supply fails. It will remain closed until manually re-set.

The design of the automatic shut-off is novel in that only one diaphragm is used—yet the regulator is positive in action. The construction of this regulator is simple and fool-proof.

Since the face-to-face pipe connections are the same on this model as on the standard model without the new feature, this new regulator can instantly be fitted into any space formerly occupied by the standard model.

Reynolds New, Improved Model 10 High Pressure Service Regulator

The new Reynolds improved Model 10 regulator was designed as an outgrowth of the very fine results that Reynolds secured in stream-lining the gas with their toggle type regulators. It is so designed that it affords automatic loading of the outlet or delivery pressure, or it can be made to hold a uniform straight-line performance. This double service feature, gives the user either loading or straight-line performance with his regulators.

The improved Model 10 regulator is equipped with a long, flexible helical spring. However, the top is so designed that the overall dimension from top to bottom of the model is no greater than in the original Model 10 series. Spring is removable without removing regulator top—affording quick change.

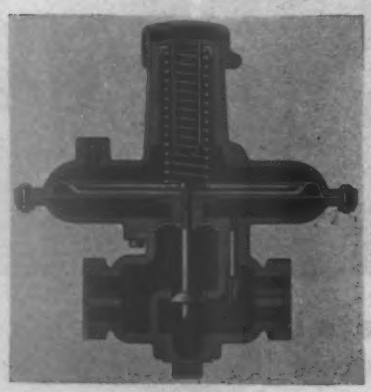
All parts are interchangeable and non-corrosive—and the working parts of the improved model can be used in

any original Model 10 regulator to improve capacity and performance. The improved Model 10 regulator is manufactured in dead weight or spring type, with or without mercury seal, in all pipe sizes from ¾" to 2" inclusive.

Reynolds Model R-425-E

On gas engine work, linotype machines, domestic or industrial installations where great sensitivity in regulation is required, the Reynolds Supersensitive Low Pressure Regulator gives excellent results.

It is a single valve type with spring adjustment. On maximum inlet pressures up to one pound, reducing to inches W. C., this regulator gives ac-



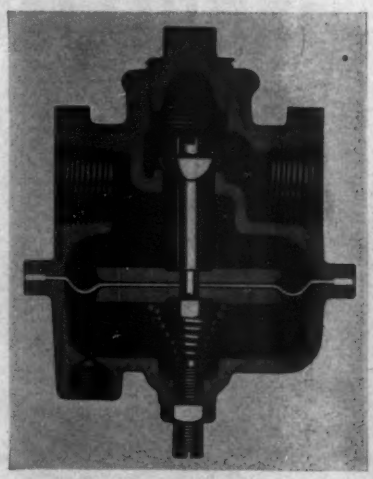
curate and very sensitive control of delivery pressure on large volumes. It is manufactured in all sizes from ¾" to 2½"—all screw connections.

Reynolds Model R-10016-E1

A low pressure regulator for automatic gas stoves, Model R-10016-E1 is a compact unit with brass body in either spring or dead weight (solid top) styles.

It is recommended for a maximum inlet pressure of 1 pound, reducing to inches W. C., and for accurate control of delivery pressure with a maximum of 130 cu. ft. 0.6 sp. gr. gas per hour.

The growing demand for a small, compact regulator for reducing pounds to inches W. C. has resulted in the design of the R-10060 series.

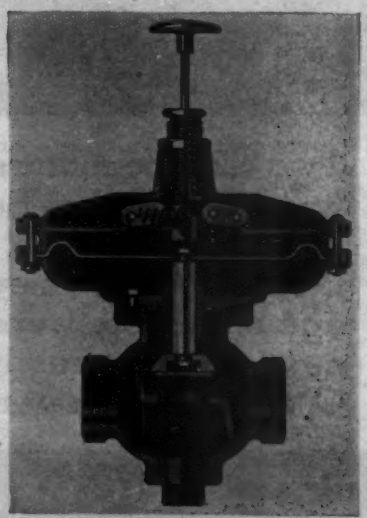


This Reynolds regulator is recommended for use where the pressure is in pounds, and it is necessary to operate appliances on low pressure. It is also an ideal regulator where the pressure is too high for satisfactory operation of the small, low pressure regulators on refrigerator installations. In such cases, this regulator is used to reduce the line pressure to a satisfactory pressure for the operation of the low presure refrigerator regulator.

Model RS-350

When the pressure in the line drops to a predetermined point, this Reynolds Automatic Shutoff Valve instantly stops the flow. It operates either on gas or air.

After the valve closes, it is so designed that should the line pressure increase, the valve will remain closed and



must be opened manually. This is a decided safety factor—the pilots are again placed in operation before the gas is turned on.

Reynolds

For Gas Control

Reynolds' Products

HIGH PRESSURE SERVICE HOUSE REGULATORS
Straight Lever Type—
Models 0-10-20 series
Toggle Lever Type—
Model 30 series

LOW PRESSURE SERVICE or APPLIANCE REGULATORS

DISTRICT STATION REGULATORS, SINGLE OR DOUBLE VALVE
Auxiliary Bowl and Automatic Loading Device Optional

HIGH PRESSURE LINE REGULATORS
Pilot Loaded—Pilot Controlled

TOGGLE TYPE REGULATORS
Single Valve, Double Valve, Triple Outlet

SEALS
Dead Weight or Mercury

Back Pressure Valves . Automatic Quick Closing Anti-Vacuum Valves . Automatic Shut Off Valves . Lever Operated Valves . Louver Operated Device Atmospheric Regulators . Vacuum Regulators.

Recognized Gas Control Since 1892

● For over forty years, Reynolds Gas Regulators have proved their ability in a field outstanding for its rigid requirements.

Proper regulation at the station, in the line, in industrial plants, in the home—for every kind and type of pressure control equipment used in the gas industry, there is an especially designed product by Reynolds.

Reynolds has always lead in the development of gas control equipment that will give satisfactory control limits, capacity range and economic operation over a long period of time.

BRANCH OFFICES: 421 Dwight Building, Kansas City, Mo.
2nd Unit, Santa Fe Building, Dallas, Texas

REPRESENTATIVES: Eastern Appliance Co., Boston, Mass.
F. E. Newberry, Avon, N. J.
G. H. Unekefer, 428 Boyd St., Los Angeles

REYNOLDS GAS REGULATOR CO.
ANDERSON . INDIANA.

Dresser Products

DRESSER STEEL COUPLINGS, STYLE 38

An efficient flexible joint for steel, cast-iron and wrought-iron gas lines. Easily and quickly installed by inexperienced labor. They are made to withstand any pressure that the pipe will carry. Provide sufficient flexibility in the line to take care of expansion, contraction, vibration, shifting ground, etc.

Style 65

Style 38

DRESSER COMPRESSION COUPLINGS, STYLE 65

A new, unique, self-contained pipe joint for standard, steel-pipe sizes from ⅜" to 2" I. D. Comes completely assembled and is installed in a few seconds with but one tool—a wrench. Makes a tight, flexible connection on plain-end pipe.

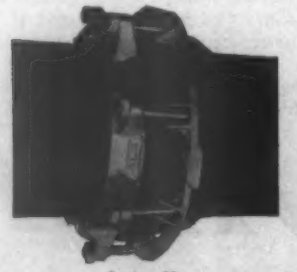
DRESSER CAST SPLIT SLEEVES, STYLE 26

Style 26

This sleeve (rubber packed) is designed for repairing (by completely enclosing) broken bells on bell-and-spigot cast-iron pipe. It may be installed under pressure under conditions that make it impossible to pour a joint. It provides a means of quickly and permanently repairing broken bells. Sizes 3" to 24" inclusive.

DRESSER BELL JOINT CLAMPS, STYLE 60

Leaking bell-and-spigot joints can be permanently repaired by the use of these clamps. On account of their ability to absorb vibration and allow pipe movement, they are designed for use on both old and new lines, on bridges, under railroad tracks or under other service conditions where difficulty may be experienced in keeping ordinary bell-and-spigot joints tight. This newest Dresser clamp, which has an adjustable anchor ring and also an adjustable follower ring, replaces the Dresser clamps formerly furnished



Style 60

which were known as Style 4½ ND and Style 4½ HP. These older styles may still be ordered, but only Style 60 clamps are kept in stock.

DRESSER CAST SPLIT SLEEVES, STYLE 57

Leaks, breaks, and splits in the straight section of cast-iron pipe can be repaired easily, quickly, and permanently with Dresser (rubber-packed) Cast Split Sleeves, Style 57. The single unit sleeve shown has an inside clearance of 8" between end gaskets.

Style 57

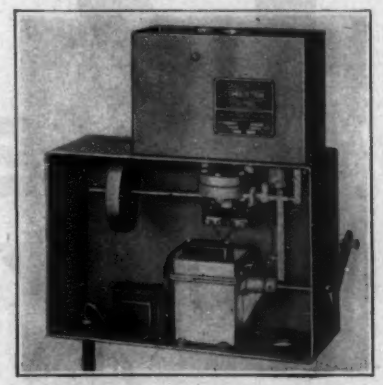
Two or more units may be joined together by the use of simple joiner parts. Ordinary laborers can easily make repairs with these sleeves in a wet ditch or even under water. The sleeve is available in sizes up to and including 12".

Style 53

These products are manufactured by the S. R. Dresser Mfg. Co., Bradford, Pa.

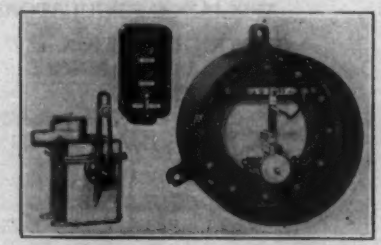
New Shallcross Controls

An automatic draft control device, manufactured by Shallcross Controls,



Inc., Milwaukee, Wis., acts to increase the CO_2 and at the same time reduce the flue temperature. These are the results of two causes—(1) the proper control of the indrawn air and (2) the retaining of the hot gases within the boiler a longer time, resulting in a greater heat transfer and in a decreased volume of gases.

This control maintains a constant draft within the furnace by continually adjusting the stack damper. It is of the full floating type, the damper being always adjusted to that position (anywhere between fully opened to fully closed) which will result in the desired



draft in the furnace, no matter what the rate of firing.

The draft switch is of the diaphragm type, fully enclosed from dirt and with removable cover. It is adjustable up to 3 tenths inches draft.

The Type MC Combustion Control for steam boilers is another one of their products. It operates as follows: A steam pressure element, sensitive to pressure changes of less than one per cent of normal, actuates a motor driving a crank (or sheave) connected to the speed control member of the stoker or to the fuel valve of the gas or oil burners.

As the load varies, the fuel is readjusted to meet the new load conditions, maintaining at all times the necessary steam pressure. The control is of the "full floating" type—it makes slight re-adjustments in the fuel on small load changes, larger adjustments on larger changes—always just that amount of fuel change necessary to maintain the boiler pressure.

DRESSER

BUILDS A LEAK-PROOF PRODUCT FOR EVERY PIPE LINE PROBLEM

COUPLINGS AND LONG SLEEVES FOR ALL KINDS AND SIZES OF PLAIN END PIPE
CLAMPS FOR VARIOUS TYPES OF DEFECTIVE JOINTS ON EXISTING LINES
STYLE 38, 36"
STYLE 38, 12" I.D.
STYLE 53, 12" C.I.P.
STYLE 40, 6" I.D.
STYLE 38, 1¼" I.D. SERVICE COUPLING
STYLE 65, 1" I.D.
STYLE 60
STYLE 73, 12" I.D.
STYLE 52-A, 12" I.D.
STYLE 41
STYLE 26, 12" C.I.P.
STYLE 55
STYLE 57, 12" C.I.P.
STYLE 57, 12" C.I.P. MULTIPLE INSTALLATION
STYLE 54-A, 16" O.D.

COUPLINGS AND LONG SLEEVES

STYLE 38 Steel Couplings make PERMANENTLY TIGHT, flexible connections between plain-end pipe sections, are quickly and easily installed by unskilled labor, are rubber gasketed, and absorb all normal pipe movements. Sizes: ⅜" I.D. to largest pipe diameter for all kinds of pipe.

STYLE 40 Long Sleeves serve the same purpose as Style 38's, but are installed on widely separated pipe ends. Sizes: ½" I.D. to 24" O.D. inclusive.

STYLE 53 Cast Couplings are like Style 38, except cast. Sizes: 4" to 30" inclusive.

STYLE 65 Compression Couplings have screw followers instead of bolts to compress the gaskets. Sizes: ⅜" I.D. to 2" I.D. incl.

CLAMPS

Dresser Clamps repair leaks in various types of pipe joints. They can be applied by unskilled labor without interruption of the service, give a permanently tight repair and are made by the world's largest and oldest builder of clamps.

STYLE 60 Ball Joint Clamps are adjustable, have a continuous gasket recess, and a sealing "pack" scientifically designed and PROVED. Sizes: 3" to 60" inclusive.

STYLE 41 (and 4) Collar Clamps prevent and repair leaks in screw collars (screw couplings). Sizes: ¾" I.D. to 12" I.D. inclusive.

STYLE 55 Porous Weld Clamps permanently repair porous but not broken welds. Sizes: 2" O.D. to 26" O.D. inclusive.

SPLIT REPAIR SLEEVES

Dresser Split Sleeves completely enclose and permanently repair breaks, splits, holes and defective joints of all types. They can be applied quickly, by unskilled labor, in any weather, under water, etc. All are rubber packed. Special styles of welded steel sleeves are built for unusual conditions or odd sizes.

STYLE 52-A Sleeves repair welds, screw collars, splits, holes, etc. Inside length: 8". Maximum working pressure: 500 lbs. per sq. in. Sizes: 4" I.D. to 26" O.D. inclusive.

Style 73 Sleeves are used for the same purpose as Style 52-A, except maximum working pressure is 250 lbs. per sq. in. Inside length: 8". Sizes: 2" I.D. to 12" I.D. inclusive.

STYLE 26 Sleeves repair broken bells on cast iron pipe. Maximum working pressure: 150 lbs. per sq. in. Sizes: 3" to 24" inclusive.

Style 57 Sleeves are identical with Style 73, except made for cast iron pipe sizes. Maximum working pressure: 250 lbs. per sq. in. Sizes: 3" to 12" inclusive.

Multiple Installations of two or more Style 57 or 73 Split Sleeves, for repairs longer than 8", can be made with simple joiner parts.

Style 54-A Sleeves repair leaking joints of the bolted coupling type on steel pipe. Maximum working pressure: 500 lbs. per sq. in. Sizes: 2" I.D. to 26" O.D. inclusive.

WRITE FOR FURTHER INFORMATION!

S. R. DRESSER MANUFACTURING COMPANY

Recent Improvements in Large Capacity Tin Meters

The Superior Meter Company, Brooklyn, N. Y. has made a distinct betterment in their recent innovations in their line of large double expansion diaphragm meters. These meters have capacities of 600, 1100, 2500, 4000 and 7000 cu. ft. per hr. and operate on a 2" initial pressure with a ½" differential.

These Expansion Diaphragm meters embody all the best features of the "A" and "B" type with a saving in space, as well as a lower capital investment and a substantial saving in labor charges.

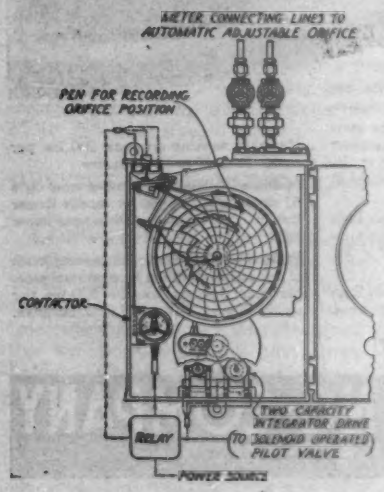
Special valve construction using "Superior" white metal alloy composition eliminates the "noisy" condition, and the reduced valve bearing area together with the direct valve drive secures a minimum of friction. All bearings and movable parts constructed of special bronze alloy are designed to take care of the increased capacity. The ingenious construction of flag wires and carriage eliminates the extra bearings, thereby getting away from the lost motion previously experienced in this type of meter.

Complete information on these and other Superior products furnished upon request to Superior Meter Company, 167 41st St., Brooklyn, N. Y.

Superior Large Capacity Meter

Bailey Automatic Adjustable Orifice

An adjustable orifice which automatically shifts its position in accordance with major changes in rate of flow, is a new development of Bailey Meter Company, Cleveland, Ohio. This device, when installed in a pipe line and connected to a standard recording and integrating Fluid Meter, greatly widens the flow range which may be accurately covered by the meter.



The Bailey automatic adjustable orifice is similar in appearance to a hydraulically operated gate valve. The gate, however, is a sharp edged orifice segment, co-efficients for which have been accurately determined. Its position varies the size of the office opening through which the fluid measured must pass.

Movable stops limit the stroke of the hydraulic piston so that the orifice segments rests in either one of two definite positions. The piston which positions the orifice is actuated by a solenoid operated valve, which in turn is commanded by contacts made in the recording meter. Through the solenoid valve, hydraulic pressure is admitted to either end of the cylinder and the other end is opened to drain.

Under an increasing flow condition, the orifice shifts position at a higher rate of flow than it does under a decreasing flow condition. This overlap prevents constant shifting when conditions are such that the flow holds closely to the change-over point.

An Improved Air-Gas Torch

This torch is unusual in that it may be used with various kinds of gases, such as natural gas, manufactured city gas, butane, propane, etc., in connection with compressed air. It is especially interesting to shops and plants of all kinds located where natural gas has replaced, or will replace, manufactured city gas.

This torch, known as the TORIT No. 26, is positively leak-proof.

The TORIT No. 26 Torch is designed so that the gas and air are thoroughly mixed, which is necessary for maximum efficiency. To further increase the efficiency of this torch, two tips, instead of only one, are supplied. This will be especially appreciated when natural gas is being used.

Particulars regarding the Torit No. 26 Torch, for radiator soldering and for all sorts of work requiring a flame, may be had from the manufacturers—the Torit Manufacturing Co., St. Paul, Minn.

SUPERIOR

Gas Meters

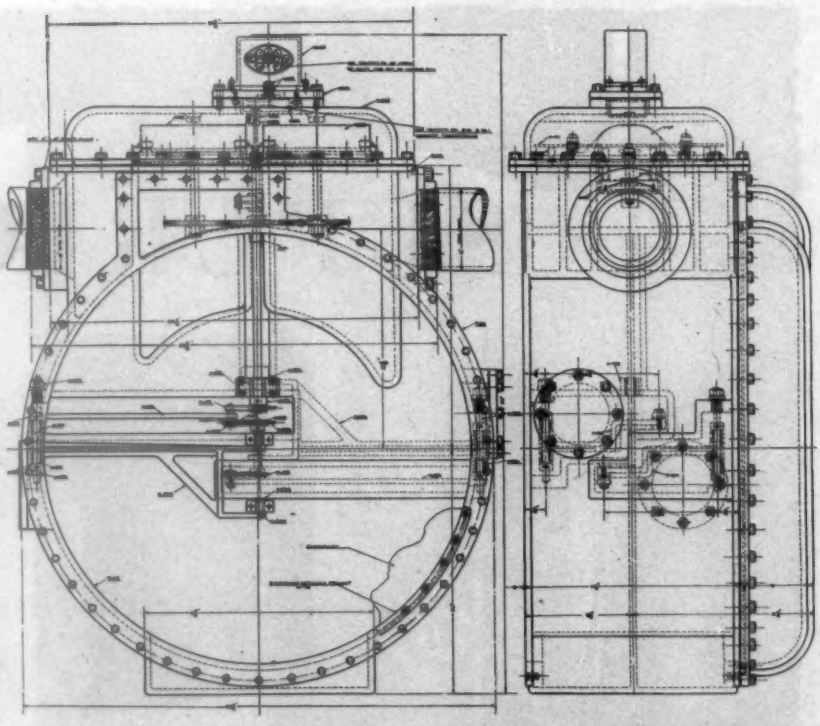
Wet Test Meters
Demonstration Meters
Service Cleaners
Provers
Diaphragms
Semi-Chrome Bark-Tanned
Repairs

SUPERIOR METER COMPANY
BROOKLYN
New York

Large Capacity Meters for Industrial Purposes

In 1932 the Sprague Meter Company, Bridgeport, Conn., announced the manufacture of a positive displacement meter having a capacity of 32,000 cubic feet per hour and designated as No. 20. The design and performance of this meter was so acceptable to the Gas Industry that they have just recently brought forward an intermediate size having a capacity of 10,000 cubic feet per hour and designated as No. 7. The same materials, such as duralumin, graphite-bronze, stainless steel and other non-rusting and non-corrosive materials, have gone into its fabrication. The salient points of these meters are: Sturdy construction, working pressures up to 75 lbs., acme of simplicity and accessibility, small number of moving parts, only one stuffing box in the entire meter, self-lubricated bearings, double adjusted diaphragms.

A convenient comparison of the two meters (No. 20 and No. 7) are given below:



	No. 7	No. 20
Floor space	2'x2'2"	4'x3'
Width	26½"	42"
Height	39"	57"
Depth	24"	32"
Flange connections	4"	6"
Capacity @ ½" differential	4,000 cu. ft.	15,000 cu. ft.
Capacity @ 1" differential	6,400 cu ft.	21,000 cu. ft.
Capacity @ 2" differential	10,000 cu. ft.	32,000 cu. ft.
One revolution of tangent	3,333 cu. ft.	15 cu. ft.
Provinging head on index	10 cu. ft.	90 cu. ft.
Index reads to	10,000,000 cu. ft.	100,000,000 cu. ft.

Sprague Streamline Pressure Flow Regulator

In 1932 the Sprague Meter Company brought forward a Booster type regulator which was the forerunner for future regulator performance and which pointed the way for future developments in regulator design. Since the inception of the Booster device the Sprague Meter Company has made another forward step in developing a streamline flow regulator along lines diametrically opposite than those used in the booster design—lines that embody the principles of aerodynamics and which entirely eliminate all mechanical loading devices. This newly designed regulator is known as the "Sprague Streamline Pressure Flow Regulator," the performance of which maintains a uniform outlet pressure at the burners from the smallest flow to 1,500 cubic feet per hour. This feature has made it possible to modernize all their older models at a nominal cost.

Sprague Pressure Flow Regulator

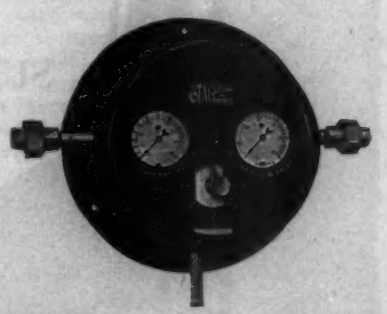
Semi-Chrome Processed Diaphragms

The Sprague Meter Company are the pioneers in the use of semi-chrome leather. This was in 1924. Now they are using processed diaphragms, whereby stabilization of the leather eliminates meters being out of proof, particularly in the case of untreated natural gas. Their new diaphragm oil mixture does not vaporize in natural gases under extreme high temperatures nor does it solidify in low temperatures.

New Tag Number 40 Controller

A new instrument to be known as the TAG NUMBER 40 Controller, ideally suited to the majority of automatic control applications, has been recently put on the market by the C. J. Tagliabue Mfg. Co. of Brooklyn, N. Y.

The principle of control is basically the TAG movement. It has been redesigned for compactness in such a fashion that the few simple parts are accessible. Tube systems can be interchanged easily.



A novel spring lever designed to eliminate all lost motion multiplies the movement of the powerful capsular spring for sensitive yet positive control. The smallest change in temperature is transmitted positively and with great precision to the TAG Ball Air Valve which in turn resets the rate-of-flow through the diaphragm actuated control valve. In the TAG NUMBER 40 Controller the sensitiveness is high and the accuracy is permanent.

Indicating and Non-Indicating types in nine convenient temperature ranges and three pressure ranges are available in this new controller.

"The more we get Together...

. . . *the better off we'll be.*" This paraphrase of the old song may well be considered as the theme for the 17th annual convention of the American Gas Association which meets in Chicago this month.

This past year has witnessed an active growth of a realization that there is a public psychology affecting the gas industry nationally which transcends the limits of local boundaries.

Our indicated course is clearly one of cooperation as an industry on an even larger scale than heretofore, for the purpose of safeguarding our business and enlarging public acceptance of gas as the ideal fuel for industry and for the home.

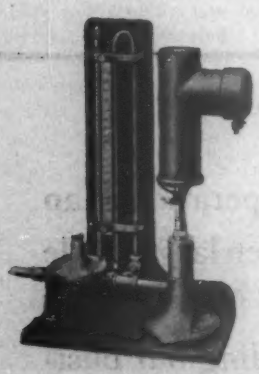
We have achieved much in the past through cooperation in technical and other lines. The present period urgently requires the same kind of intelligent cooperation in telling the public about our product and our services.

CONSOLIDATED GAS COMPANY OF NEW YORK

Connelly Caloroptic & Other Products

Protection against interruptions of service is a subject of increasing importance. A reliable and inexpensive protection is available in the Connelly Caloroptic. Manufactured by the Connelly Iron Sponge & Governor Co., Elizabeth, N. J., fitted with a distant signal and alarm unit. The standard Caloroptic, which is in wide use as a B. T. U. Indicator has been altered to include a photronic cell which is used to operate the signal and alarm unit on which the desired limits of B. T. U. value can be set. The dial on the distant unit indicates the slightest change in heat value.

When the B. T. U. reaches the high or low limits a light shows on the distant unit and a signal is sounded indicating that attention is required.



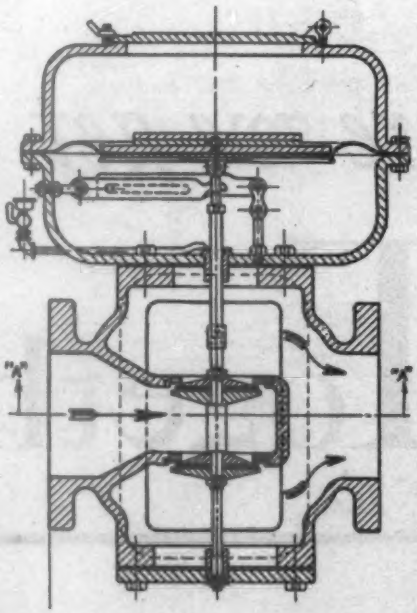
The combination is especially valuable on mixed gas. For butaneair plants, this device is used to throw out the main switch when the B. T. U. leaves the desired range thus closing down the plant.

Connelly District Regulators

Change overs from low pressure to high pressure distribution are frequently very expensive. Systems using the Connelly Mercury Seal Regulators can be conveniently changed over at low cost by simply changing the Mercury Seal Float Control to Diaphragm Control. As a rule, regulators should all be overhauled when major changes in pressure and volume are made. With Connelly Regulators the alterations are readily made by fitting new valves and seat and changing the control mechanism. One large Gas Company using Connelly Regulators avoided purchasing new regulators for their changed conditions and thus saved thousands of dollars.

Connelly Purifying Materials

Connelly Mixed Filler consisting of hard wood chips and half coarse shavings withstand rough using in handling. Operators report an increase of 25% in the length of time the Connelly



"Iron Sponge" prepared on Mixed Filler can be used before the material must be discarded due to fineness. The chips prevent excessive packing in the box and provide better porosity.

Connelly Type GV Loading Regulators

The Connelly Regulator, Type GV, has been perfected to give a decided loading as the flow rate increases. The sample curves indicate the gain in capacity obtained with the new Connelly design. Its good points are; simplicity of design and construction; accessibility for inspection, cleaning and renewal of parts; and convenience of serving without removing the Regulator from the line.

Natural Gas Reforming Equipment

The illustration herewith is of a complete unit of equipment for the reforming of natural gas whereby natural gas can be reduced to any practical desired heating value and combustion characteristics.

The equipment is built for continuous operation and the first unit of this kind constructed, after being in continuous use for a year, showed practically no signs of depreciation.

There are a great many applications of natural gas where lower heating value of gas and definite flame characteristics than those of natural gas are required and there are also a number of applications for equipment of this kind where producer gas is to be replaced with natural gas.

The advantage of using a reformed gas where producer gas has formerly been used is that it burns satisfactorily in the same combustion chambers and in case the natural gas service is discontinued temporarily, the producer installation can immediately be put into operation and the plant operations continue without interruption.

The operating and fixed charges are practically negligible and greater economy is secured by using natural gas in this manner than is possible with other fuels. Manufactured by The Gas Machinery Co., Cleveland, Ohio.

Natural Gas Reforming Unit

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General design engineering,
investigations, reports and estimates,
and construction supervision for
new or modernization projects in the
utility or industrial fields

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American Meter Has Incorporated Results of Active Research in Current Products

Of vital concern to every gas company executive interested in metering costs is the research work carried on during the past four years by American Meter Company.

On tin meters alone, outstanding results have been achieved on the following research undertakings, which are just a few of the many successfully projected:

Accuracy at low rates of flow, effect of lost motion and stuffing box friction on proof, bearing corrosion, strength of parts, survey and exhaustive tests of all raw materials, including stuffing box greases, leather treatments, leather substitutes, etc.

ON IRONCASE METERS, research has achieved the following noteworthy developments:

Improvements to h.p. meters including lubrication of all moving parts and protection from dust; Base Pressure and Base Volume Indexes; 500 lb. positive meter, differential valve, etc.

Ironcase Meter Developments

Ironcase Meter Cut-Away View.

In general form and in details the Metric Ironcase Meter has been designed to give accuracy and long service at low annual cost, according to the manufacturers. For instance, in the casing a selected gray iron is used. This resists for a long period any damage from the corrosive action of injurious gas constituents. For double protection a special Bakelite coating—scientifically applied by skilled operators to the inside and outside of every case—is added.

Ironcase Meters are designed on the principle that gas never passes through a seamless fine grain iron casting. Hence, table, partition, outlet channel, and diaphragm channels of every Ironcase Meter are cast in one piece. Seams in Ironcase Meters occur only in exposed portions of the case and every precaution is taken to make them leakproof. Special cork gaskets are used that remain resilient to allow for difference in expansion from temperature changes, for freedom from development of leaks and avoiding the use of paste preparations. The cap screws of high pressure meters, have a tensile strength of 160,000 pounds per square inch. Similar precaution has been taken

Tinned Steelcase Meter

with valves and seats. They are cast with exactness and uniformity, and are ground to make them gas tight.

Tinned Steelcase Meter

American Meter Company through research, test and experimentation has improved its Tinned Steelcase Meter. Standardized methods of analysis for both leather and oil have enabled that company to produce diaphragms to effectively meet varying conditions. Fact finding experiments are continuously under way, state company officials. New metals, and Bakelite have been adopted for parts which could be improved by these innovations, to meet specific conditions. The entire design has been subjected to repeated test for even the slightest possible improvement, according to company engineers. Manufacturing methods have received the same study. These and other developments are described in Bulletin TG-4.

Base Pressure and Base Volume Indexes

Base Pressure Index

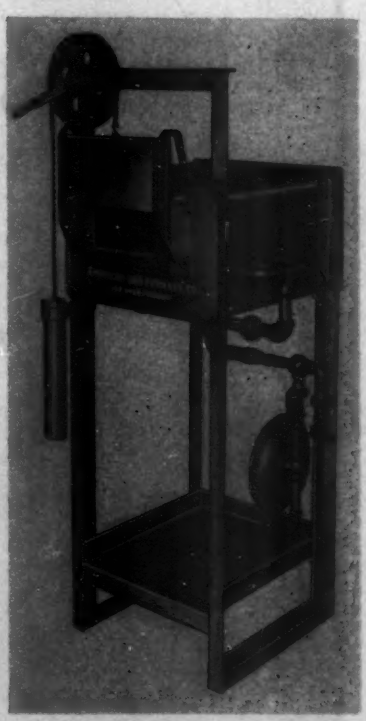
The Metric base pressure index gives a totalized reading of the quantity of gas which has passed through the meter in cubic feet (at the base pressure). Each cubic foot (actual volume at line pressure) is multiplied by the factor for line pressure.

The Metric base volume index registers the total quantity of gas which has passed through the meter in cubic feet at standard conditions of base temperature and base pressure. Each cubic foot (actual volume at line pressure) is multiplied by the factor for flowing temperature, and this product is subsequently multiplied by the factor for line pressure.

Either type of index is furnished with a supplementary counter in the rear which gives a reading of the actual volume of gas at line pressure. This information is required when the volume and pressure gage is used. Any volume and pressure gage supplied by the American Meter Company can be readily installed on the top of the base pressure index or the base volume index, and the chart from this gage will serve as a permanent record of the rate of flow and pressure. It can be used as a check reading if desired.

A New Tool Room Furnace

An improved tool room oven furnace, made by American Gas Furnace Co.,



Elizabeth, N. J., is of interest to industrial engineers. It has a new type of insulating refractory lining, which weighs about half as much as fire clay linings and has several times the insulating properties. A feature of this furnace is the one-valve control which regulates the input over the entire operating range with a turn down ratio of six to one. The ratio of air to gas input can be adjusted by means of the ratio cock to give any desired furnace atmosphere. Operating range from 1200° to 1800° F.

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SPRAGUE
CAST IRON GAS METERS

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REGULATORS

for

low, medium, and high pressures

Accurate in Measurement.

Economical in Service.

THE SPRAGUE METER CO.

BRIDGEPORT, CONN.

BOONE-CHILTON

Today, when Utilities are weighing fundamental values as never before, the unvarying quality and actual worth of BOONE-CHILTON Gas Coals are receiving their highest recognition.

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Regulation of Oil and Gas Pressure Becoming Safer and More Exact

In the use of either gas or oil for industrial purposes, accurate regulation is important as an aid to economical operation. Because this is recognized, the demand for sensitive regulators has increased during the last few years.

The Fulton Duplex Sensitive Differential Gas-Air Regulator, manufactured by The Chaplin Fulton Manufacturing Co., Pittsburgh, Pa., is an example of advancement in sensitiveness and accuracy. The duty of this regulator is to reduce a medium gas pressure to low pressure, and maintain on the outlet side of the regulator a pressure always equal to the fluctuating air pressure at some point in an air line. In other words, the gas pressure at the outlet of the regulator is kept equal, at all times, to the fluctuating air pressure at a certain point in the air-distribution system.

Cut-Out Latch Regulator

Duplex Sensitive Differential Gas-Air Regulator

The diaphragm is connected to the upper lever, its power being directed to the main lever at such a distance from its fulcrum as to multiply it four or five times, which is equivalent to increasing the diaphragm surface several times, and increasing the power of the governor to control the valve in like proportion.

The fluctuating air pressure is piped to the under side of the diaphragm, and the gas pressure is piped to the upper side of the diaphragm. When the air pressure rises, the diaphragm is forced up, opening the valve slightly, increasing the gas pressure, and thus keeping a balance and maintaining zero differential pressure.

Safety in the use of gas has been provided by The Chaplin-Fulton Manufacturing Company in its development of the Fulton Cut-Out Latch Regulator. For oil burning equipment, the Fulton Back Pressure Regulator, with Automatic Cut-Out Latch, is offered.

The purpose of the Fulton Cut-Out Latch Regulator is to stop the flow of gas through the body when the pressure on the diaphragm falls to a given point. It is provided with a cut-out latch, which automatically holds the valve to its seat, when the pressure on the diaphragm fails. It is used principally in connection with low-pressure burners and furnaces where the purpose is to protect such equipment against hazards due to failure of the gas supply. Should the gas pressure drop below a predetermined point, the function of this regulator is to shut off, immediately, the supply of gas to the burners, and at the same time, lock the valve in such a manner that the gas cannot be turned on at the burners without the operator's going to the valve and opening it by hand.

Portable Testing Machine

The growing demand for accurate knowledge of weld strength is the natural result of great developments in welding. In fabrication and in pipe line work, engineers now consider it essential to know with close exactitude the actual strength of welds as they are made. Also knowledge that the welds are as strong as the plate being welded is frequently desired.

The Air Reduction Sales Company, New York, N. Y., has developed the Airco Portable Tensile and Bend Testing Machine, which is a compact, comparatively light machine that can be carried right to the welding job so that welded specimens can be tested on the spot

The machine consists of an oil pump, a hydraulically actuated piston or ram, two heads—one fixed and one movable—for gripping the test specimens, and four symmetrically located steel shafts, two of which transmit the piston motion and load to the movable head. The other two shafts maintain the alignment of the two heads, and prevent the introduction of bending stresses in the tensile test specimen.

By means of a long lever attached to the pump, and the ratio between the areas of pump plunger and hydraulic ram, the downward force on the pump lever is magnified four hundred times in the load applied to the test specimen.

The load on the test specimen is indicated on a 6-inch pressure gauge of special construction, carefully calibrated against a standard dead weight tester. The gauge is designed to maintain its accuracy under the strains of usage and shipping.

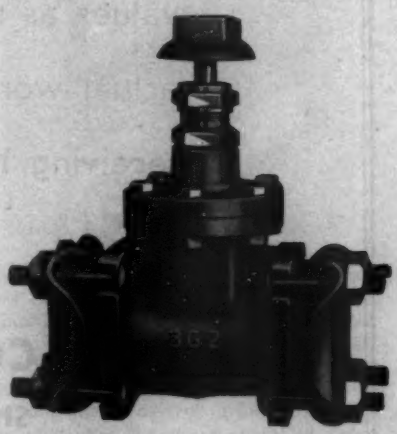
For the bend test, the machine is provided with an anvil which fits into the movable head, and which bends the specimen against a pair of supports set 3 inches apart and cast integral with the body of the machine.

An important feature of this testing outfit is its easy portability. A solid hardwood base upon which the machine is permanently mounted forms part of the packing case. Sides and top of the case are assembled with screws. A few minutes with a screw driver frees the machine for immediate use, or packs it for shipment to another job. A separate box contains the gauge, carefully packed to protect it in transit. The entire unit, machine and case, weighs only a little more than 200 pounds and can be handled freely without damage to the machine.

Ludlow Gas Valves

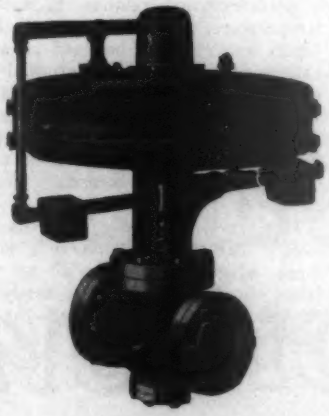
The G-2 type gas valve shown in illustration shows the Ludlow method of employing the Dresser Coupling. A standard Dresser Coupling is cut in two: one-half being cast integral in each end of the valve by a process which guarantees a gas-tight joint throughout the life of the valve.

Ludlow G-2 Valves are furnished with regular stuffing boxes unless otherwise ordered, and can be supplied with Coster boxes when requested at a slight increase in cost.



The gate and wedging mechanism is of the well-known time-tested Ludlow design—rugged and reliable.

The sizes run from 1¼" to 6", made by Ludlow Valve Mfg. Co., Troy, N. Y.



Fulton Duplex
VACUUM
REGULATOR

An effective
SAFEGUARD

CF

ON VAPOR LINES connected to a storage tank for the recovery of gases, the Fulton Duplex Vacuum Regulator prevents pulling a vacuum in the tank. When tank pressure has been released by removal of gases, the regulator will close. It is so constructed that it can not do otherwise. Write for Bulletin 2499 describing this very definite safeguard for vapor lines.

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Keeping Abreast With the Times
NATURAL GAS REFORMING APPARATUS
CONTINUOUS OPERATION
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NATURAL GAS MAY BE REDUCED TO CONFORM TO PRACTICALLY ANY *DESIRED HEATING VALUE AND FLAME CHARACTERISTICS*

REPLACES GAS PRODUCERS

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Especially applicable for

GLASS ANNEALING FURNACES, SOAKING PITS, ORE ROASTING FURNACES, LIME KILNS, ETC.

HIGH EFFICIENCY **LOW CONVERSION COSTS**

COMPLETE GAS PLANT CONSTRUCTION

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16100 Waterloo Road Cleveland, Ohio.

The Onward March of the Water Heater Industry

An economic depression lifts our voice in a wail or a shout to preach the doctrine of materialism. We find a special delight in telling how we can get along on less, that this is no time for feelings and emotions, and that we must sacrifice pleasure, for this is the time to don sack-cloth and to save. It is true we have made automatic water heaters more efficient and more economical during this time, but it is also true that we began telling our customers that they could get along on less hot water, states Fred H. Leder of Cleveland Heater Co., Cleveland, O.

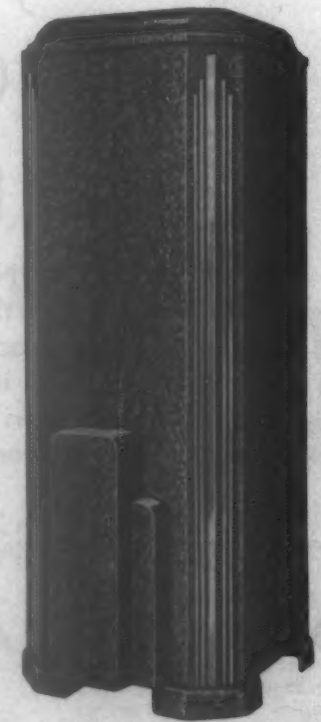
By no means is the gas industry the only industry beset by the demon of materialism. Rather it has been very much spared. The fact is: The gas industry leads in scientific and technical developments of home appliances. And much of what has been accomplished is the result of energetic efforts of water heater engineers and manufacturers.

Looking back a few years when business was not so good, let us reason "why?" Because people did not buy? True. But why is it true? It is true because we did not furnish them with incentives to buy, nor did we give them a reason for buying. We did give them pure material facts.

We talked efficiency and economy, low gas consumption, and low prices until we were blue in the face. As a result we did sell some automatic water heaters, but as soon as we begin to compare our record with those of the refrigeration and automobile industry we feel very much ashamed. Something was missing, something was wrong. And that something was an emotional appeal. A reason for buying. A water heater that showed that it was up-to-date, that it was modern.

It was not lack of appreciation of the public but the materialistic attitude of the builder of water heaters and the gas engineer that should be blamed for the low aesthetic standard of the water heaters of 1934. Lower costs are always appreciated by the public, but, above all, does the article look well in the home, does it fit into the scheme of things, and is it modern? These are the questions every purchaser turns over in his mind when selecting something new. Materialistic reasons for buying are "left-hand" and not "right-hand" problems when selecting merchandise for the home. For every person does want some pleasure in addition to utility out of everything he buys, and water heaters are no exceptions.

Yet materialism need not mean crudity. Why should not the new water heater of the modern age spread beauty and elegance, rather than ugliness and vulgarity? This question has stimulated water heater engineers of the Cleveland Heater Company to action. Out of their rich experience and knowledge comes the Rex Nu-Mode Automatic Water Heater.



Rex Nu-Mode Automatic Water Heater

Modernism, practicability and economy are combined here. If you have a flair for beauty of line you will like the practical design of this massive water heater. If you have an eye for color this new water heater will thrill you. The square design with cut-away corners is finished in dull crinkle-enamel. The cut-away corners are trimmed with chromium plated ornaments which blend beautifully in the water heater design as a whole.

The eye of the artist, interested only in beauty, sees in the Rex Nu-Mode the fullest possible expression of his ideal. It fits into anyone's home. It vies with the range and the refrigerator for a cherished place in the kitchen, or with the furniture of the basement recreation room.

Taylor Reset Controller

The new Taylor Reset Controller, recently developed by the Taylor Instrument Companies, Rochester, N. Y., may well be regarded as another milestone towards the goal of providing Industry with completely automatic process control. This new control instrument is an outgrowth of the so-called "differential controller" which has been used chiefly in air-conditioning work, but its potential uses are vastly greater due to the fact that it incorporates all of the advantages of the Taylor "Fulscope" control mechanism and can be easily adjusted to meet a great variety of requirements.

In general, it controls a temperature, pressure, rate of flow, or liquid level, in a predetermined relation to some other temperature, pressure, rate of flow, or liquid level. It can be used on all applications where a fixed differential must be maintained between two variables, one of which is under control; or where it is desirable to change the control point of a process in accordance with a predetermined ratio to a secondary process or condition.

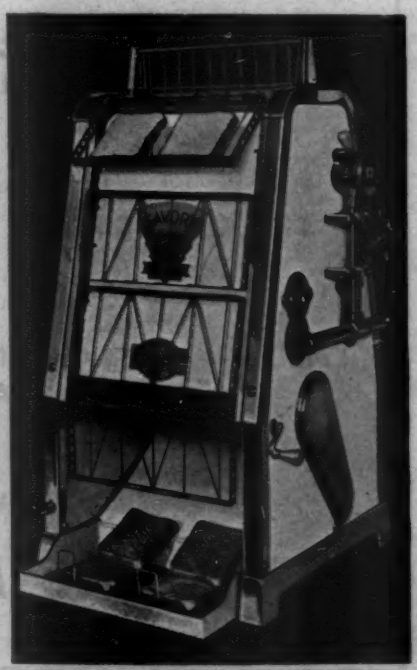
Two types of ratio adjustments are possible, "direct" and "inverse"; either of these adjustments as well as changes from one to the other are easily accomplished in the field without the aid of additional parts.

Savory Toasters

Savory Appliances, Inc., Newark, New Jersey, have manufactured a line of gas toasters and broilers for use in hotels, restaurants, universities, hospitals and all kinds of food service establishments. These include the Savory Toasters, which produce toast of superior flavor and uniformity.

The Sandwich Model XB Savory Radiant Gas Toaster is now adapted to roll warming, the baskets being replaced with small bars and can warm up to 500 rolls per hour.

The Model BG Savory "Cooking Compact" includes the Savory vertical radiant heat broiler, a warming oven with heat indicator and hot plate with gradual heat control, and many other new features It also has an open burner top designed especially for use in conjunction with glass coffee makers. This section can be used as well for deep fat frying, boiling and other cooking operations.



REX
NU-MODE
AUTOMATIC
WATER HEATER

New

NEW IDEAS for better homes. A new way to improve the appearance of the basement. A new and better water heater.

If you are looking for news that will be translated into something easier to sell and quicker profit, the Rex Nu-Mode Water Heater opens up a whole new field for the water heater sales department.

The sheer beauty and distinctive appearance of this sensational new water heater, the result of combining material and manufacturing methods entirely new to the industry, sets it apart from other types of water heaters.

It changes the entire sales picture and provides an opportunity to sell modernization and home comfort.

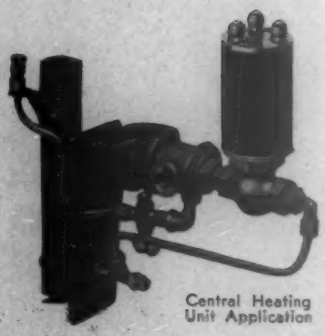
It offers a convenience and utility that have never been approached before; a design that is ultra-modern and strikingly beautiful.

Craftsmanship is reflected in the Rex Nu-Mode Automatic Water Heater. It makes every home-owner a logical prospect. Its obvious utility and practicability are real incentives to buy.

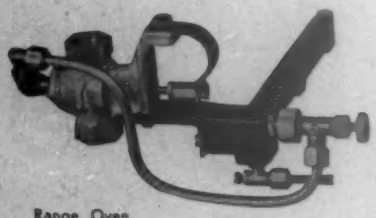
THE CLEVELAND HEATER CO
1900 W. 112th St. Cleveland, Ohio

"PATROL" SAFETY IGNITION SYSTEM

REG. U.S. PAT. OFF.



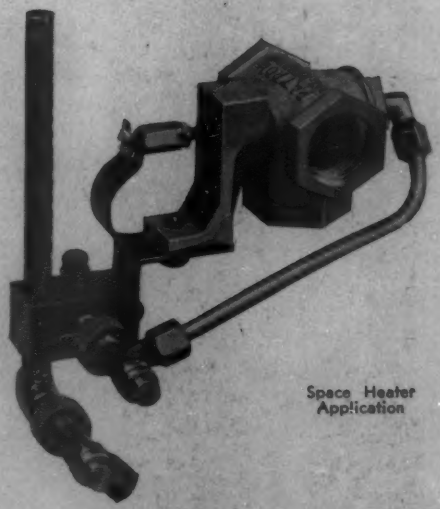
Central Heating Unit Application



Range Oven Application

Automatic Storage Water Heater Application

Conversion Burner Application



Space Heater Application

Combined

PILOT SAFETY VALVE *and* MAIN GAS CONTROL

PATROL reduces the cost of control mechanism on any gas appliance.

The PATROL VALVE is the MASTER control in the main gas supply, with any desired limit controls installed in series in the bleed line of the relay pilot.

Our Engineering Staff will be glad to cooperate in working out the details of your particular application.

THE PATROL VALVE CO.
Locust Ave. Cor. W. 114th St.
CLEVELAND, OHIO

THE PATROL CYCLE

is covered by U. S. Letters Patent under the following numbers and others:

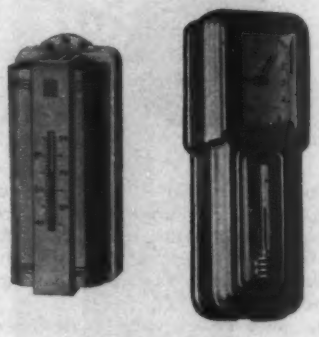
1,457,127
RE. 18,135
1,842,126
1,842,327
1,842,331
1,842,332
1,842,334
1,842,335
1,842,336
1,842,339
1,971,704

"THE PILOT FLAME THAT LIGHTS THE GAS ***TURNS IT ON!***"

Minneapolis-Honeywell Temperature Controls

Acratherm

This is a newly designed and engineered heat accelerating type thermostat. This instrument is receiving immediate and widespread acceptance due to the fact that it is not just another thermostat but a real advance in the field of temperature control. It provides exceptionally even room temperature, insures distribution of heat throughout the heating system, and avoids both overheating and underheating. It automatically compensates for the variables encountered in every heating system under all weather conditions. In addition its design is modern and exceptionally beautiful.



Chronotherm

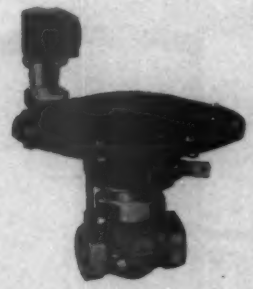
This instrument, although well known to the gas industry, continues to be a very popular control because in addition to having all the qualities of the Acratherm, it provides the economy and comfort of lowered night temperature. In fact, it is the only instrument which provides both leveled heat and lowered night temperature.

Time-O-Stat

This new addition to the Minneapolis-Honeywell line is of particular use on installations where the initial cost will not allow the installation of the Chronotherm. It is provided with a means for manually setting for the length of time which the temperature is to be lowered either at night or other periods with automatic return to the normal daytime temperature at a predetermined hour. It is simple, durable, and attractive in appearance.

L119 Airstat

A simple Series 10 Airstat without differential adjustment. This device is a very low priced limit control for warm air heating plants and we believe should be the means of making a limit control standard on all gas installations.



T11-V16-6 Regulator Package

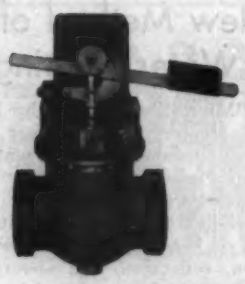
This is an inexpensive Regulator Package, including a Series 10 silent solenoid gas valve with automatic recycling and the T11 Acratherm.

V15-5 Gas Valve

An improved model of the generally used and accepted V15 Motorized Gas Valve.

V118-1 and V119-1 Valves

These valves are similar to the V117-1 except that they are furnished in larger sizes. The V118-1 is available in the 1½", 2", and 2½" sizes, the V119-1, or flanged type, in the 3", 4", and 6" sizes.

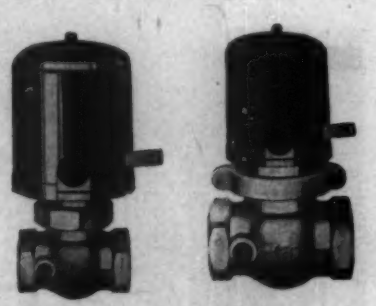


V15-9 Gas Valve

This new valve model makes larger size valves available in the simple V15 low voltage type equipment. It provides 1½", 2", and 2½" quick opening valves in the lower priced motorized valve field.

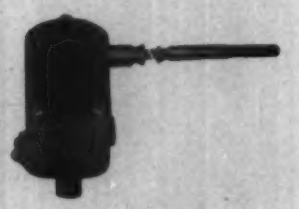
V107-1 Slow Opening Valve

This is a new slow opening gas valve incorporating all the features of flare pilot, automatic recycling, slow opening, and adequate power for handling dampers on large heating and semi-industrial installations.



V117-1 Electric Diaphragm Gas Valve

A Simple diaphragm control system incorporating the Series 10 electric circuit for use with either electric or gas actuated pilots, and also a feature for handling secondary air dampers. One of its outstanding features is the ability to use it interchangeably with the V15 Motorized Valve and thus make the application of control equipment more practical in D.C. districts. This valve is available in ¾", 1", and 1¼" sizes.



C89-1 Pilotstat

This is a new thermocouple type automatic shutoff device for use with Series 10 equipment. Its principle of operation is very popular and gives you extremely quick automatic shutoff in case of pilot failure.

These controls are manufactured by the Minneapolis Honeywell Regulator Co., Minneapolis, Minn.

A New Method of Gas Water Heating

The "Mirro-Shell," made by Handley Brown Heater Co., Jackson, Mich., makes an automatic storage water heater out of the old range boiler.

The view of the interior of the "Mirro-shell" heater shows the new method of heat application—combining radiation, reflection, and absorption of heat. The heat is generated by a small gas flame within the burner box at the bottom of the heater. The heat radiates through the walls of the burner box and the brass tubes used to carry the products of combustion and is reflected by the three sided non-tarnishable chromium plated metal mirror surface through the walls of the range boiler into the water.

The products of combustion are within the tubes and never come in contact with the mirror surface or the surface of the range boiler. Only filtered heat is within the heating chamber.

A black strip the width of this chamber is painted on the range boiler to increase absorption and the outside of the brass tubes are blackened to increase heat radiation. The heat reflecting chamber is closed at the top so that air cannot circulate through this space though the air within this space can circulate to better carry the heat units to the water within the range boiler.

Insulation

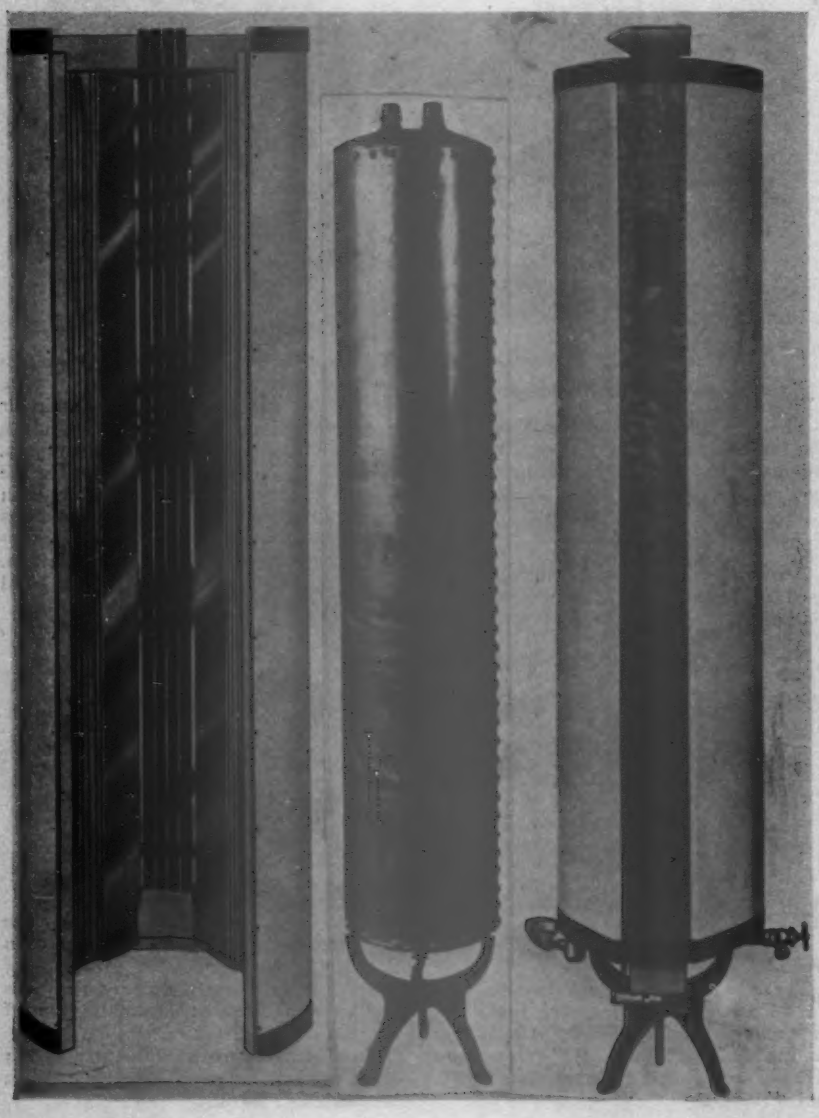
The range boiler is insulated with ¼ inch of Rock-Wool, a sheet of heavy corrugated asbestos backed with 1¼ inch of kraft paper and a metal jacket. The reflecting heat chamber has behind it a small dead air space, ¼ inch of fine fibrous asbestos, ¼ inch of corrugated asbestos, 1¼ inch of Rock-Wool, a sheet of heavy kraft paper and the outside steel jacket.

Installation

Installation is simple and inexpensive. No water connections are needed. The "Mirro-Shell" is placed around the boiler after piping used with furnace coil, coal heater, oil heater, water back, etc., has been removed, top insulation applied, a ¾" gas line connected, burner and thermostat assembly and pressure regulator attached and the job is completed.

The "Mirro-Shell" can be taken down and moved very easily if the customer moves.

The illustration shows the "Mirro-Shell," the old range boiler and the job when completed.



New Controls for Gas Space Heaters

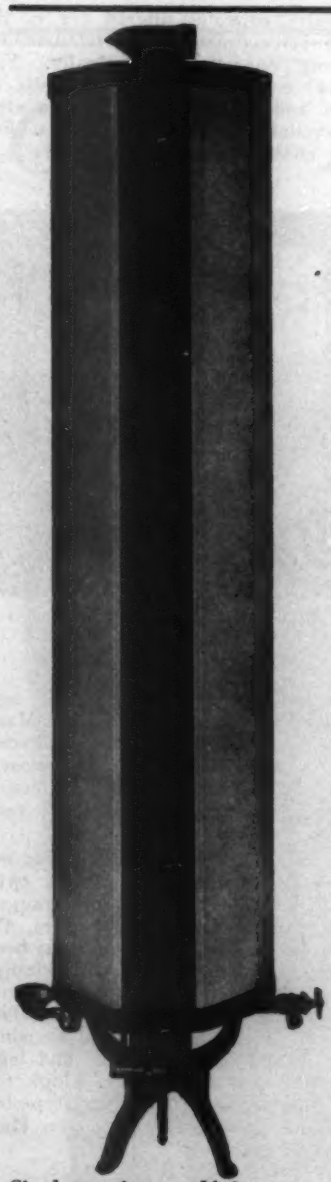
This new control is designed to combine automatic room temperature regulation and protection against pilot flame failure in a single compact unit, and is applicable to any gas space heating appliance.

The pilot safety valve is designed to be held in its open position by means of the heat of the pilot flame expanding the inert gas filled thermal bulb, which acts against an over-centered KLIXON snap acting disc. When pilot failure occurs the inert gas-filled bulb cools, allowing the Klixon disc to snap the valve to closed position. It requires a combination of pilot flame heat and manual reset to again open the pilot safety valve.

The thermostatic element is described as a sensitive corrugated disc, operating a small snap-acting valve in the blood line of a diaphragm gas valve. When the thermostat calls for heat the bleeder valve opens, allowing escapement of gas from above the diaphragm, permitting the main gas valve to open. When the thermostat is satisfied the reverse of the above cycle takes place.

The thermostat unit may be mounted directly on top of the diaphragm valve, making possible automatic regulation of room temperature by piping the unit into the supply line to the appliance. The thermostat unit is also provided separate from the diaphragm valve for wall mounting, in which case connection between the thermostat and diaphragm valve is made by means of small copper or aluminum tubing to provide for control of bleed gas escapement and consequently main burner operation as dictated by the thermostat.

This equipment is manufactured by Spencer Thermostat Company, located at Attleboro, Massachusetts.



"LET'S STOP *and see..*
Handley-Brown's NEWEST"

ONE ANNOUNCEMENT . . . AND THE ENTIRE GAS INDUSTRY, WITH AN EYE FOR LOAD-BUILDING, TOOK NOTICE!

30,000 CUBIC FEET
— OF ANNUAL [YEAR-ON-YEAR] CONSUMPTION
FROM AN APPLIANCE RETAILING AT
$34.75

ALL Yours With

MIRRO-SHELL

A Revolutionary New Method of AUTOMATIC GAS WATER HEATING

Single unit combining heating element and insulation.
Condensation completely eliminated.
No circulating troubles, circulation achieved through natural law; no mechanical controls needed.
No liming, no sediment troubles.
Low-pressure regulator, thermostat and safety pilot standard equipment.
No water connections needed for installation.
Attractive Morocco finish on 24-gauge steel jacket.

MAKES AN AUTOMATIC STORAGE WATER HEATER OUT OF THE OLD RANGE BOILER

Introduction of the Mirro-Shell has proved one of the most important domestic gas load building announcements in years.

New?—more than "new," it's revolutionary in its method—combining radiation, reflection and absorption of heat; revolutionary in what it can be made to do for desirable and permanent gas load. Opens a new "moderate and low-income" market never before satisfactorily reached; makes automatic gas heating prospects out of tank users; ends range boiler trade-in resistance.

LOW FIRST COST opens your market; LOW OPERATING COST holds and extends it. Low price and simplicity also mean big appeal to co-operating dealers. Can be quickly installed by one man. Mirro-Shell makes the customer's range boiler into a very attractive, highly efficient heater.

A 3-cent Investment for Permanent Gas Load

Operating and sales executives will find this of prime importance to load building plans. Write now for full details, prices, terms.

HANDLEY BROWN HEATER CO.

JACKSON, MICHIGAN

Developers and Pioneers of the Low-input Gas Water Heater

S. G. E. Ranges

The extent to which the Standard Gas Equipment Corpn., New York has gone in offering to the industry ranges of different design and capacity can best be judged by the fact that the

8316 ETS Series.

latest price list issued as of October 1st covers:

32 Insulated table-tops
24 Partially insulated table-tops
4 Insulated consoles
8 Partially insulated consoles
10 Insulated 6 burner tops
10 Non insulated 6 burner tops
4 Insulated 8 burner tops
10 Partially insulated 8 burner tops
30 Single oven models insulated and non-insulated
6 Junior ranges
43 Insulated Smoothtops
43 Partially insulated Smoothtops

The above totals 224 models for domestic use. Add to this 40 additional models in colors that can be supplied and you have a fairly good idea of the total stock models that must be carried for the convenience of the industry.

The No. 8316 ET Bel Geddes model supplied in two finishes with or without dual-duty burners is the DeLuxe model. Having many modern convenience features and absolute rigid construction it is classed ultra-modern and recommended for model kitchens. Two lift covers conceal both cooking top and work-top. Broiler is on same level as oven.

The No. 4600 series is the latest table-top addition to the line and supplied in either white or ivory enamel. Six insulated and eight partially insulated models are available. This is a full 40" table-top in the moderate price brackets. Slightly higher in price is the 6600 series of which there are nine models insulated and twelve partially insulated. This price range also includes nine insulated and twelve partially insulated 36" tabletops.

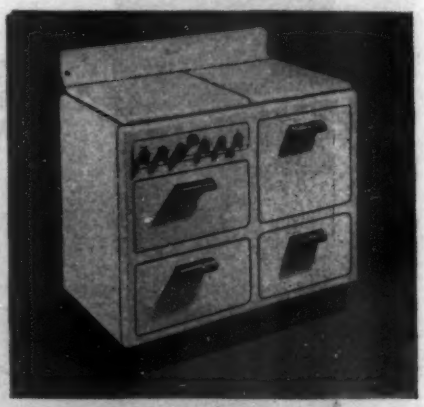
No. 3616-1 series. A comparatively new line of low price table-tops constituting four insulated and nine non-insulated models of the 36" table-tops. Four of these can be supplied with monel metal work tops. Oven and broiler are 16" wide. Heat control is concealed in storage compartment.

No. 4600 Series

No. 3616-1 Series

No. F-1620 Smoothtop. An entirely new series of Smoothtops fully insulated, equipped with two heat controls and featuring fully enameled Smoothtop. Supplied in both full white or full ivory enamel with either legs or enclosed base. Elevated warming closet furnished if desired. An outstanding advantage of this new line is the simplicity of adjustment and replacement parts. All adjustments are made in front of range and replacements of all enamel parts can be made without disconnecting gas. In addition to these eight numbers the complete E series are available and offers a selection of Smoothtops comprising seventy-six ranges supplied in gray and white or green and ivory enamel, semi-enamel and standard finish.

Twelve consoles offered are in the lower price brackets and featured for building operations principally. Full enamel models in gray and white or green and ivory, semi-enamel models are available in the same colors. For large cooking requirements there is a



F-16W Series

variety of six and eight burner tops insulated and partially insulated. Many of these have two heat controlled ovens, others have elevated warming closets and elevated broilers. A fine selection for large apartments and large residences.

The S. G. E. line is well rounded out with a large number of single oven ranges, kitchenettes and junior ranges. Among these is the B-50 series, the newest of the line. This series has been developed to fit in the modern kitchen as a built-in unit harmonizing with other kitchen equipment such as cabinets, etc. It can be furnished in white or ivory and has black base and legs. Full 16" oven and broiler. Cook top is of standard size. Four bowl type top grates are concealed by lift cover. Heat control is optional.

B-50 Series

Get It Now! This *New* Catalog of 224 Domestic Ranges

Ranges for large kitchens, small kitchens or kitchenettes, DeLuxe ranges, moderately priced and low priced ranges. Ranges for every purpose and every purse—that's what we have included in this new catalog.

The Industry must be served and Standard Gas Equipment Corporation takes the initiative with a well balanced line comprising:

- 32 Insulated table-tops
- 24 Partially insulated table-tops
- 4 Insulated consoles
- 8 Partially insulated consoles
- 10 Insulated six burner tops
- 10 Non-insulated six burner tops
- 4 Insulated eight-burner tops
- 10 Partially insulated eight burner tops
- 30 Single oven models insulated and non-insulated
- 6 Junior ranges
- 43 Insulated Smoothtops
- 43 Partially insulated Smoothtops

Here is a line of ranges complete in every detail. Good workmanship—sturdy construction — solid appearance — features galore. They sell because they have a more-for-the-money appearance.

VULCAN Heavy Duty Equipment—Another S. G. E. line that is complete in every detail. Ranges, broilers, bake ovens, deep fat fryers, confectioners' stoves, griddles, short order stoves, hot-plates, industrial burners for all purposes. All the modern improvements including top temperature control.

Vulcan heavy duty hotel and restaurant ranges are A. G. A. approved.

STANDARD GAS EQUIPMENT CORPORATION

18 EAST 41st STREET, NEW YORK

BALTIMORE BOSTON CHICAGO PHILADELPHIA LOS ANGELES

PACIFIC COAST DISTRIBUTORS—NORTHWEST GAS & ELECTRIC EQUIPMENT CO., PORTLAND, ORE.

Latest Magic Chef Gas Ranges

The new Magic Chef series 1400, marks the tendency of modern interior design. Besides the standard Magic Chef features, this range has a chrome finish tubular steel frame and light standard, chrome finish removable feet, service shell for condiment set and clock, divided cooking top with porcelain enamel or monel metal work top, insulated oven and broiler.

Series 2100

This new series was designed in response to a demand for a range of somewhat larger cooking capacity in the popular table top model. It is unusually roomy with extreme dimensions of 40¾" wide and 30½" deep. The oven is extra deep —20". It has the drawer type, smokeless grid pan broiler with drop door, two utensil drawers, spring-balanced cooking top cover.

Magic Chief Series 2100

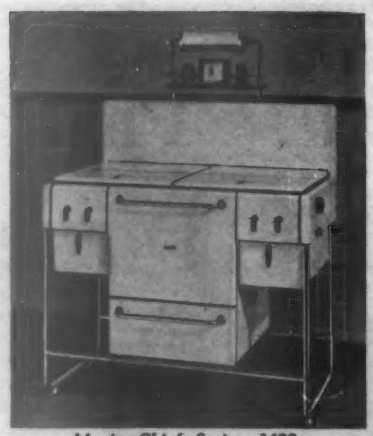
Also these exclusive Magic Chef features: Red Wheel Lorain Oven Heat Regulator, Magic Chef Automatic Top Lighter, Three-In-One Non-clog Top Burners and Sanitary High Burner Tray.

Door and drawer handles are of bar type. Gas valve handles are of black bakelite.

Series 2500—Right hand oven only

Standard equipment includes insulation and these exclusive Magic Chef features: Red Wheel Lorain Oven Heat Regulator, Magic Chef Automatic Top Lighter, Three-In-One Non-clog Top Burners and

Magic Chief Series 2500



Magic Chief Series 1400

Sanitary High Burner Tray. Toasting compartment with rack, beneath the baking oven. Oven and broiler valves are of safety type. Enameled throughout. Door and drawer handles and gas valve handles harmonize with color scheme.

This series can also be furnished with Monel Metal cooking top, High Burner Tray and Grid section of Broiler at an additional cost.

These ranges are manufactured by the American Stove Co., Lorain, Ohio.

Silica Gel Dehumidifier

The Bryant Silica Gel Dehumidifier, manufactured by the Bryant Heater Co., Cleveland, Ohio., embodies a new principle in conditioning for summer needs in the home, office, hospital, restaurant, factory, etc.

Able to achieve independent control of humidity and temperature, this new equipment represents a distinct departure in method from conventional electric or turbine-driven refrigeration systems which achieve humidity control by means of low temperatures. It embodies in concrete form the recognition that discomfort from summer weather is due *not* to the heat, but to the *humidity*. First dehumidifying, and then cooling by a separate operation with separate equipment, the system combines the advantages of perfect adaptibility, effectiveness and economy.

The Silicia Gel Dehumidifier employs the adsorption method for dehumidifying. The material used—Silica Gel—is a hard, hygroscopic, manufactured substance, similar in appearance to clear quartz granules, although extremely porous. When moist air is brought in contact with Silica Gel, the pores of the material adsorb the moisture. Easily reactivated by heat, Silica Gel can be used indefinitely. It never "wears out."

The Silica Gel Dehumidifying unit consists of Silica Gel, supported in suitable compartments, fans for conveying adsorption and activating air through the beds; heater, motor, cooler, and suitable automatic controls.

Its principle of operation is briefly this: Air to be dehumidified enters the unit through a large duct in the base, is carried to a compartment, and forced through Silica Gel beds in a manner assuring fullest contact with the greatest amount of the Silica Gel. When the dehumidifying operation is complete, the air is conducted into the cooler.

The processes of adsorption and activation are continuous. There are two compartments, each of which alternately adsorbs and is activated—a performance made possible by rotating valves which change the intake and the activation air stream six times an hour by opening and closing "ports of entry" for the activating air as well as for the air to be dehumidified. Thus, when one compartment is being activated, valve operation prevents humid, untreated, incoming air from entering it. In the same way, activating air is prevented from entering a compartment during the dehumidifying period.

Gas Range with Kitchen Heater

A new gas range with a kitchen heater has recently been manufactured by the Hammer-Bray Co., Ltd., of Oakland, Calif. This is called the Spark-Lid-Top Gas Store and has the following features: An Adjusto-Grid Broiler; a new "Hi-Low" Burner; a built-in Gas

Heater and a Spark-Lid-Top; Automatic Oven Control and Automatic top-burner lighter.

MAGIC CHEF

AUTOMATIC HEAVY-DUTY EQUIPMENT

FOR MODERN GAS COOKING

CHECKS ON 7 MAJOR POINTS

● Magic Chef Automatic Heavy Duty Equipment was designed only after careful study was made of the modern requirements of representative hotels and restaurants. It is more than a coincidence, therefore, that Magic Chef, in its outstanding advantages, checks to a dot on the chief points stressed by the most progressive users of this type of equipment.

√ ECONOMY—Magic Chef gives more usable heat units on a smaller consumption of gas. Full insulation on top, bottom and sides of oven as well as front, sides and under cooking top, the famous Magic Chef burners with their even spread and wide range of heats, controlled secondary air and fast-heating cooking top all contribute to substantial savings of gas.

√ EFFICIENCY—Fast heat, accurately controlled and concentrated where desired is the secret of Magic Chef efficiency. The Red Wheel oven regulator, high speed, wide range Magic Chef burners, flued top and radiants to store heat are special, exclusive features.

√ CONVENIENCE—Automatic lighting of both oven and cooking tops saves both time and gas.

√ CLEANLINESS—Easiest equipment on market to clean and keep clean because of streamline design, continuous cooking top, concentric burner trays and coved rim at back to catch all splash and boil-overs. Other features contributing to this advantage are concealed flue, concealed bolts, closed joints and sanitary construction throughout.

√ SAFETY—Special safety pilot fully enclosed and protected against drafts. This pilot prevents gas from entering oven burner unless pilot is lighted. Automatic and exclusive.

√ COMFORT—Cooler kitchens through full insulation and air-cooled side compartments. Air-cooled gas cocks, mixers and burners.

√ DURABILITY—Scientifically built for long dependable service with special features of special alloy cooking top, sturdy angle iron frame, air-cooled door springs instead of pulleys or chains.

Write for complete information.

LOOK FOR THE RED WHEEL WHEN YOU BUY A MAGIC CHEF

AMERICAN STOVE COMPANY

World's Largest Manufacturer of Gas Ranges

BOSTON • NEW YORK • ATLANTA • CLEVELAND • CHICAGO
ST. LOUIS • PHILADELPHIA • SAN FRANCISCO • LOS ANGELES

Magic Chef
AMERICAN STOVE COMPANY

Robertshaw Oven Heat Controls for Domestic and Commercial Use

Gas heat controls are a part of the equipment of every modern gas range. Robertshaw Thermostat Co., Youngwood, Pa., specializes in the manufacture of gas thermostats for domestic and commercial uses.

The Model XC Robertshaw is the latest model of gas range thermostats. It is easily installed and it combines the control and the oven valve in the arrangement.

The Robertshaw heat control for commercial cooking, includes the flexible couple types, rigid couple types and with diaphragm quick acting type controllers.

Left—
Robertshaw
Flexible
Couple Type
Heat Control

Right—
Robertshaw
Rigid Couple
Type Heat
Control

Round Oak Ranges

Two popular models of the Round Oak Ranges, manufactured by the Round Oak Company, Dowagiac, Mich., are the Chief four burner and Chief six burner double oven described herewith.

Chief (4-burner)
(Specifications)

Full porcelain enamel... five different finishes . . . chrome finish handles . . . double hinged covers over flush cooking top . . . double action Multi-Speed top burners . . . automatic Bluflame top lighter . . . full insulation . . . Robertshaw combination safety rotary oven valve and heat control . . . cast iron oven bottom, oven and broiler linings granite porcelain finish . . . flat wire basket type non-tipping oven racks . . . pull-out broiler drawer with improved center drain broiler pan and polished aluminum smokeless grill . . . crisper compartment . . . cutlery drawer . . . utensil drawer . . . right hand oven only.

Extra: LCS—Electric light, condiment shakers and automatic timer.

Chief (6 burner—double oven)
(Specifications)

Full porcelain enamel . . . chrome finished handles . . . double hinged covers over flush cooking top . . . double action Multi-Speed top burners . . . Automatic Bluflame top lighter . . . pastry oven and knee high broiler . . . pull out broiler drawer with center drain broiler pan and polished aluminum smokeless grill . . . full insulation . . . Robertshaw combination safety rotary oven valves and heat controls . . . cast iron oven bottoms, oven and broiler linings granite porcelain finish . . . flat wire basket type non-tipping oven racks . . . two utensil drawers.

Round
Oak
Ranges

Clean Air Makes Strongest Appeal

Experience shows that of the four features comprising winter air conditioning—heated, cleaned, humidified, circulating air—that of cleaning makes the biggest appeal to the housewife, states the Henry Furnace & Fdy. Co., Cleveland, Ohio.

One of the greatest advantages of gas for fuel is its cleanliness. However, the dust and dirt against which the housewife is waging a constant battle does not all have its source from the effects of combustion in the heating plant of the house.

One may have gas for fuel; but the neighbor burns coal, and on this account, through infiltration the house may be filled with soot and dust laden air. Even a chimney a mile away will steadily contribute its quota of dust and dirt.

Another source of flying dust is the tracked-in dirt which disintegrates, and the dust and lint arising from the wearing of carpets and furnishings and so on. Microscopic examination of dirt-filled filters reveal a surprisingly high percentage of carpet and furniture fibers.

The accompanying illustration shows three things. At the left is a section of a clean filter before it goes into use. At the right is a filter showing the appearance after a season's use. In the middle is shown a pile of dust taken from inside the return air pipe of a warm air heating system. Only a small part of this dirt originated from the inside of the house itself.

In the Moncrief Gas Air Conditioning System the filters present an unusually large surface to the circulating air. The result is a minimum of resistance to air flow and a maximum of cleaning efficiency. The filters do a better job of cleaning and last longer.

Humidification of the air is another function of air conditioning. A simple heating system makes no provision for this, with the result that the relative humidity inside of homes so heated may be as low as 10% when it should be around 40%.

The Moncrief Automatic Humidifier includes a large open pan which presents an unusually large evaporating

surface. The effective evaporation surface may be enlarged or diminished so that the correct degree of humidification may be established depending upon the particular conditions in the house.

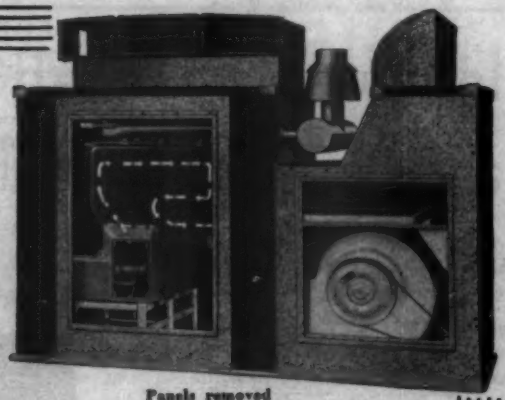
A simply constructed float valve admits water from the pipe line so that a constant water level is maintained without attention.

Air circulation is created by a large slow speed blower of the squirrel cage type. The blower and the motor are mounted on rubber, vibrationless. The blower housing is so constructed as to deliver a large volume of air with low

(Continued on page 93)

MONCRIEF Gas Air Conditioning System

So Economical It Challenges Coal and Oil Heating Plants



Panels removed showing interior construction.

Moncrief SERIES "B" Gas Furnace

Provides gas heating at lowest cost. For gravity circulation air conditioning devices may be added as desired. Same heating units as Moncrief Gas Air Conditioning System. Send for circular.

This improved air conditioning system brings the convenience of gas within the means of the home owner to whom economy is an object. It is making records for low gas consumption which are the marvel of heating men everywhere. Special construction of burners and heating chambers, patented, account for this. Winter air conditioning at its best is produced by modern proved devices including large area filters, low speed vibrationless blower, automatic humidifier, together with controls which provide for reliable, care-free operation. Beautifully finished in green and black crackle. Approved by A. G. A. Moderately priced. Send for new literature.

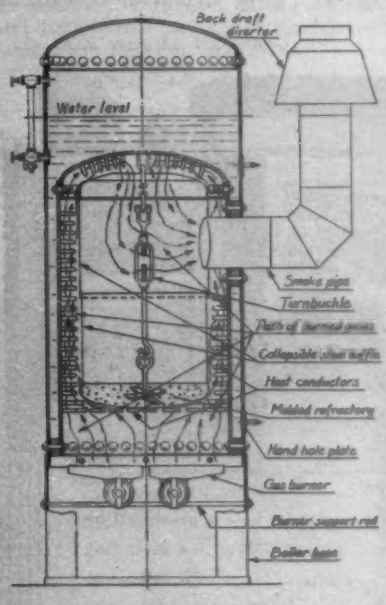
The Henry Furnace & Foundry Co.

3471 E. 49th St., Cleveland, Ohio

A New Type Industrial Gas Boiler

The design of this boiler is very similar to that of a plain internally fired water leg flueless type of boiler, but with the distinctive exception that,—pressure electric welded to the entire inside of the furnace and the crown sheet, are the HE Flueless heat conductors. A collapsible, easily removable, drum or baffle, with moulded refractory deflector is hung from the center of the crown sheet. The heat from the burners is deflected by this baffle to the sides of the furnace where it is absorbed by the U loops. The balance of the heat travel is up through the U loops to the crown sheet, then down inside the baffle and out the stack. This method of heat transfer has proven equal to that of the best of the tubular type boilers, and combined with it is the long lived flueless construction.

The standard number of hand hole openings are fitted to this boiler for clean out purposes. It is easy to clean and to keep clean. Removing the gas burners and the collapsible baffle permit access to the entire furnace of the boiler. Note particularly, that if the baffle should be damaged, the boiler may be operated without it during the repair period. The general construction is simple and accessible.



A careful study of this boiler will show that there is nothing to burn out over years of service, with the possible exception of the dry baffle. A replacement of this baffle is simple and inexpensive. The boiler does not need to be taken down. The gas burners are removed, the baffle collapsed and replaced with a new one through the opening in the base. If a new baffle is not at hand, the boiler may be operated during the waiting period without a baffle at all. The only result of operating without a baffle will be a loss of 15 to 20 percent in operating efficiency.

This boiler is made by the P. M. Lattner Manufacturing Company, Cedar Rapids, Iowa, in sizes five, eight, twelve and eighteen horsepower.

Some Estate Stove Co. New Models

The No. R-924 Estate with fresh air oven, is the "perfect 36," that is only 36 inches wide. The oven is insulated and ThermEstate controlled. It has waist-high sliding broiler; Estate grid-all—the quick easy way to grill eggs, pancakes, sausages, etc. Extra roomy utensil compartment and spring hinged covers for cooking top. Choice of six finishes.

No. R-525 is a medium-priced table-top Estate. Heavily-insulated, ThermEstate controlled Estate fresh-air oven. Roller-sliding, drawer-type broiler. Estate leveracks. Two roller-sliding utensil drawers. New spring-hinged top cover. Four top burners, one with the new simmer bar. Floor space required—38½"x27".

Full porcelain enamel finish—choice of all white, white with black top, ivory with tan or black top, Opal-Like with tan top. Optional equipment: Time Control, cooking-top lamp, two internal timers.

Estate No. R-325 is a compact table-top model for the big family or the small family that entertains in a big way. Eight top burners, two with the new simmer bar. Interchangeable griddle plate standard equipment. Two fresh-air ovens (both heavily insulated, ThermEstate controlled). Roller-sliding, drawer-type broiler. New spring-hinged top covers. Floor space required—44" x 28".

Full porcelain enamel finish—choice of all white, white with black top, ivory with tan or black top. Optional equipment: Time Control, built-in toaster or radio, cooking-top lamp, two interval timers.

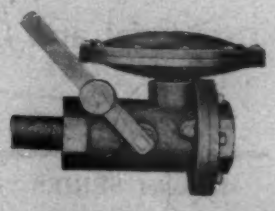
Another product of the Estate Stove Co. is the Gas Heatrola. The latest model is equipped with the ThermEstate remote heat control and safety pilot which provides completely automatic operation. The new ThermEstate is in two parts. A remote Control dial containing the thermal-sensitive element, which is placed on the wall at any suitable distance from the heater. The main gas valve is placed on the heater. Any degree of heat can be maintained by setting the dial at the desired temperature.

Automatic Shut-off and Check Valve

"Saval" Low Pressure Automatic Shut-off and Check Valves are manufactured by George W. Franzheim, of Dunkirk, N. Y.

These valves are built to close automatically in case the gas pressure falls below ½ ounce.

They must be opened by hand, which is accomplished by raising the lever and weight until the internal pawls and latches engage and hold the valve open. It will not stay open however unless the line pressure is again ½ ounce or more.



The valve has been designed in such a manner that the working parts are in continuous motion—owing to the continually fluctuating gas pressure to which all city lines are subject. This motion is hardly perceptible, but of sufficient amount to prevent the working parts corroding and sticking together.

The Saval valve can be used on low pressure installations of any size, and is intended not only for homes, apartments, office buildings, etc., but in industries using ovens and furnaces.

Air Conditioning and Gravity Gas Furnaces

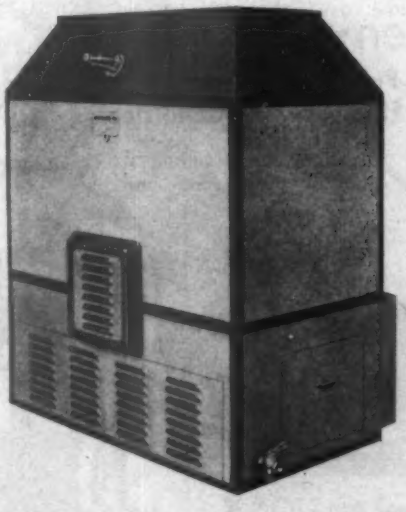
The Niagara 110 Series Air Conditioning Gas Furnace made by Forest City Foundries Co., Cleveland, Ohio, combines the healthfulness and comfort of air conditioning with the convenience and cleanliness of automatic gas heat in a simple, compact, self-contained unit.

The heat-generating equipment is scientifically designed for maximum efficiency in combustion and heat transference to the circulating air. On the sizes of 90,000, 120,000 and 150,000 B.t.u. input ratings, the furnaces are of single unit construction, requiring only one set of controls and assuring even distribution of heat at all times whether one or all burners are in operation. In the larger sizes, double-unit construction is employed, and the controls are operated simultaneously. This type of construction contributes to the simplicity and overall efficiency of the unit.

Radiating Sections

The center combustion section and the radiating sections are cast iron, made with accuracy to insure uniform thickness of metal. The sides are cast with large, diagonal corrugations, placed at reversed angles on opposite walls. These set up a whirling motion of the hot gases inside, bringing them in close contact with the surface and intensifying the absorption by the metal, and, consequently, the transfer of heat to the circulating air.

The heat generated by the burning



gas rises in the combustion section, divides and passes into the side radiators through double connecting flues at the top, and then drops by gravity as the heat is transferred to the circulating air. The products of combustion, having thus been directed evenly over all surfaces and exhausted of heating energy, are vented from the bottom of each side radiator into the manifold.

Automatic Controls

The standard unit is equipped with all essential safety and operating devices. The combination blower and limit control prevents overheating and operates the blower as long as there is sufficient heat for distribution. An automatic humidifier is actuated by temperature within the hood. A safety pilot automatically shuts off the gas supply to burners and to pilot, in case the pilot flame is extinguished. The room thermostat controls the automatic gas valve.

(Continued from page 9)

power consumption. The circulating system effects a complete change of air in the home from three to five times an hour.

Low gas consumption is attained by the patented Moncrief construction of the burner and heating sections. The radiating area of the heating section is large with relation to the size of the burner, being 2,160 square inches to one 30,000 B.t.u. input burner. In addition the gas travel is also long being 112 inches from the face of the burner to the outlet, inside dimensions. The passages are so constructed as to retard the flow of the gases the better to allow the heating section to pick up the heat units from the hot gases.

Niagara Gas Furnaces Offer You Unusual and Exclusive Advantages

No. 110
Niagara Gas Air Conditioning Unit

Niagara Gas-fired Furnaces are available in both gravity and air conditioning types. They have three outstanding advantages:

1. High Efficiency. Tests conducted by the research departments of public utilities and other organizations show an exceptionally high ratio. This is achieved by Niagara's thermo-syphon and counter-flow system of heat extraction, which transfers a very high percentage of heat from the burned gases to the circulating air.

2. Elimination of Superfluous Controls. Niagara's central burner combustion chamber is responsible. Only one safety pilot is required for Niagara Gas-fired Furnaces in ordinary residences.

3. Saving of Floor Space. Note the simple, self-contained design. The upper compartment holds the heat-generating equipment, radiating sections, gas burners and automatic humidifier. The lower compartment contains the blower and filter equipment and the electrical controls.

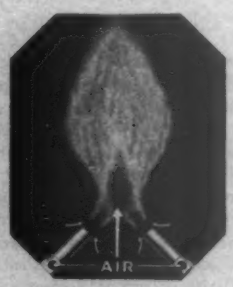
Niagara Gas-fired Systems are furnished in a full range of sizes for residence use. Shall we send a catalog?

THE FOREST CITY FOUNDRIES CO.
2500 West 27th Street Cleveland, Ohio

NIAGARA GAS FURNACES

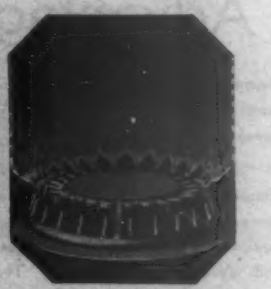
Barber Burners for House Heating

The combustion principle of the Barber Jet Gas Burner provides for the introduction of auxiliary air above the gas orifice in the jet tubes. As the premixture leaves each pair of jets, a vacuum is created which draws into the flame the additional air required to develop perfect combustion upon increased gas pressure. The perfect combustion is dependent upon its union with a proper amount of oxygen as may be extracted from the air. Note how the Barber Patented Jet Principle combustion is obtained.



Arrows indicate where necessary air is taken in to mix with gas to develop perfect combustion at varying gas pressures.

The Barber Jet Burner principle of combustion develops a flame temperature of 1,900 degrees Fahr., with 530 B.t.u. gas. It is not affected by dirt, corrosion or condensation and will not backfire or deposit carbon, under any pressure. It requires no burner adjustment, regardless of gas pressure or quality of the gas.



Barber patented "scrubbing" flame application to heater side walls—direct—no loss of heat.

Barber Jet Gas Burner

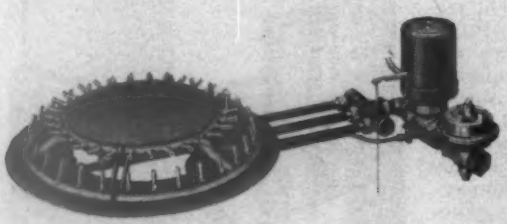
The Barber Patented Jet Gas Burner develops high efficiency in burning gas and then follows the second natural requirement for economical heating, which is—properly applying the heat. The above illustration shows how the Barber Burner applies the flame *directly* to the level, where it is needed and it scrubs the heating surfaces of furnace or boiler. The flame produced is applied *directly* to the heating surface without interfering with the completion of combustion.

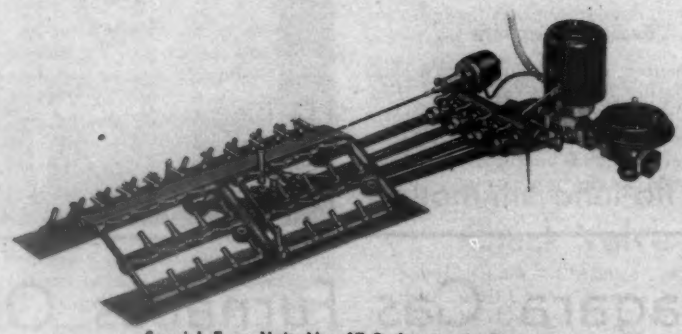
Barber Jet Gas Burners have been so improved and advanced in mechanical construction that today, low operating cost is the selling theme of all Barber Dealers.

Public Interested in Automatic Heat and Air Conditioning

In addition the public is responding to the publicity given automatic heat and air conditioning and are interested in this type of home comfort They will convert any hot water, steam, vapor or furnace system into even, completely automatic heat. The manufacturers state installation is simple and inexpensive, owing to the fact that nothing in the existing system must be replaced.

No. 336-B—Barber Automatic Burner and Installation in Round Steam or Hot Water Boiler.





Special Four Unit No. 17-B Automatic Burner and installation in Oblong Boiler.

No. 336-B Barber Automatic Burner

The accompanying illustration of a No. 336-B Barber Automatic Burner installed in a round Steam or Hot Water Boiler shows the proper adaptation of the heat to the side walls at the proper water level, utilizing all of the B.t.u. developed from combustion. Therefore it becomes necessary that the diameter of the burner enable the flame to scrub the side walls in order to obtain proper heat application. For this reason Barber Burners for round Steam, Vapor and Hot Water Boilers are provided in eight standard sizes and diameters.

For square and oblong sectional boilers having grate dimensions up to 48 by 98 inches, over 3280 various assembly layouts are provided. Such oblong burners are built to specifically suit the grate dimensions, and to precisely apply the heat to the side walls for highest consistent and proper efficiency. The illustration shows the adaptation of a special four-unit burner properly installed in an oblong boiler.

The Barber Burner Company, Cleveland, Ohio, will supply additional information on request.

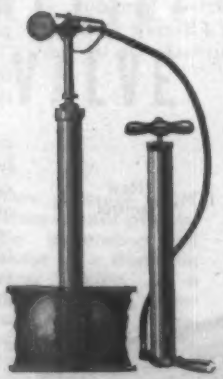
GOODMAN STOPPERS SINCE 1897

GOODMAN IMPROVED GAS MAIN STOPPER

The Reliable Shut-off for Street Mains. Now has as its newest feature the "T" Handle for easier manipulation. The Locking Sleeve (at right) holds the Stopper firmly in place. When locked in place it holds. Takes only 30 seconds. LOOK FOR THE NAME GOODMAN.

Sizes 3" to 48".

Patented



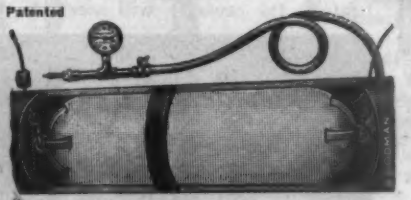
GARDNER-GOODMAN STOPPER

Patented

A stopper for low and intermediate pressures.

Patented
Improved Locking Sleeve

Patented



GOODMAN CYLINDRICAL STOPPER

DEPENDABLE GAS MAIN BAGS

Light	Type A
Medium	Type B
Heavy	Type D
Canvas Covered	Type C

PLAIN RUBBER

CANVAS COVERED

Pipe Cleaning Brushes

Type C

THE GOODMAN-PEDEN STOPPER

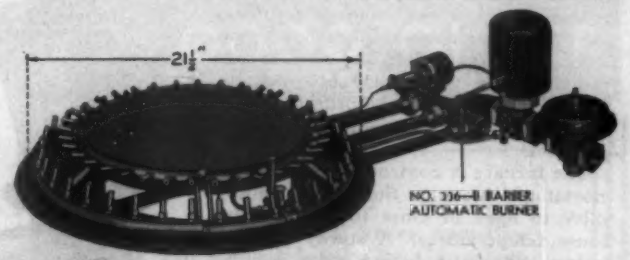
In the Goodman-Peden Stopper the flexible frame, padding, covering and diaphragm of Goodman Stopper remain in principle, but the handles have been discarded and in their stead a new arrangement in construction makes it possible to operate the stopper mechanically rather than by the experience and skill of the workman. Made in standard sizes.

TWO STYLES—WITH OR WITHOUT PLUG

Patented

SAFETY GAS MAIN STOPPER CO.
523 ATLANTIC AVE.
BROOKLYN, N. Y.

You've Heard Lots of Burner "Sales Talk"— will you listen to BARBER BURNER FACTS?



YOU are familiar with that type of sales appeal in which the imagination of the salesman (or the ad writer) exaggerates the actual merits of the product.

But your *experience* in selling gas heating appliances to the public makes you demand *not claims but* FACTS. That's why we invite your serious attention to these specific points about Barber Burners:

- Tailor-made to *suit* and *fit* the grate dimensions of square or oblong furnaces or boilers.
- Scientifically constructed for proper scrubbing flame action on side walls of firebox—and at the proper level in the combustion chamber—requiring no fire brick or refractory elements for *deflecting* the heat.
- Equipped with the improved Barber noiseless jets, unequaled for air-mixing efficiency.
- Furnished with Klixon or Baltimore Safety Pilot Control—positive and accurate.
- Listed in the A.G.A. Directory of Approved Appliances.

Write or wire for our New Illustrated Descriptive Literature and Revised Prices.

THE BARBER GAS BURNER CO.
3704 Superior Ave. Cleveland, O.

BARBER *Automatic* JET GAS BURNERS

● for Warm Air Furnaces, Steam and Hot Water Boilers ●
and Numerous Other Heating Appliances

S-C Model F Heatmaster

The Model F Heatmaster is a complete automatic air conditioning heating plant, manufactured by Surface Combustion Corp., Toledo, Ohio. It incorporates the down-draft and counterflow principles. They are used in combination with the exceedingly large heat radiation area in contact with the air stream, insuring the utilization of all the heat possible from the burned gasses. This scientifically designed system thus operates with a low gas consumption and a high efficiency.

The burners and mixers are designed to operate on exceptionally low gas pressures and at the same time entrain the maximum amount of primary air. They are very flexible and may be adjusted over a wide range of consumption with the adjustable orifices. Each of the two mixers are complete with a gas cock.

The furnace is controlled by the thermostat which causes the electric motor valve to open or close to regulate the house temperatures. A sturdy positive acting, automatic acting pilot insures dependable operation, as the gas cannot be turned on if the pilot light is not burning.

The secondary air door, which opens and closes simultaneously with the motor valve minimizes the heat loss through the flue after the burners have been turned off.

The heavy galvanized casing is equipped with an inner liner which serves as a secondary heating surface as the circulating air passes between it and the outer casing. This keeps the casing cool and minimizes the heat losses.

A cast iron evaporating, humidifying pan, enameled on the inside, is located entirely inside of the casing. This evaporating pan is of correct design and of ample capacity to insure evaporation of sufficient water for the complete humidification of the home. An access door in the hood is located so that the evaporating pan may be inspected or removed easily. An automatic float tank controls the amount of the water in the evaporating pan and can be adjusted for the desired relative humidity.

The air cleaning or filtering medium employed in the Heatmaster is of the dry type and is very easily removed and cleaned by tapping the frame lightly on the floor. It may also be cleaned with a vaccum cleaner or by washing in hot soda water. The filter removes pollen, lint, and dirt particles from the air.

New Janitrol

The new Janitrol, another product of Surface Combustion Corp., is a thermostatically controlled automatic gas burner for the conversion of round furnaces and boilers. It also is made in rectangular shape to fit furnaces or boilers having fire boxes with greater width than depth.

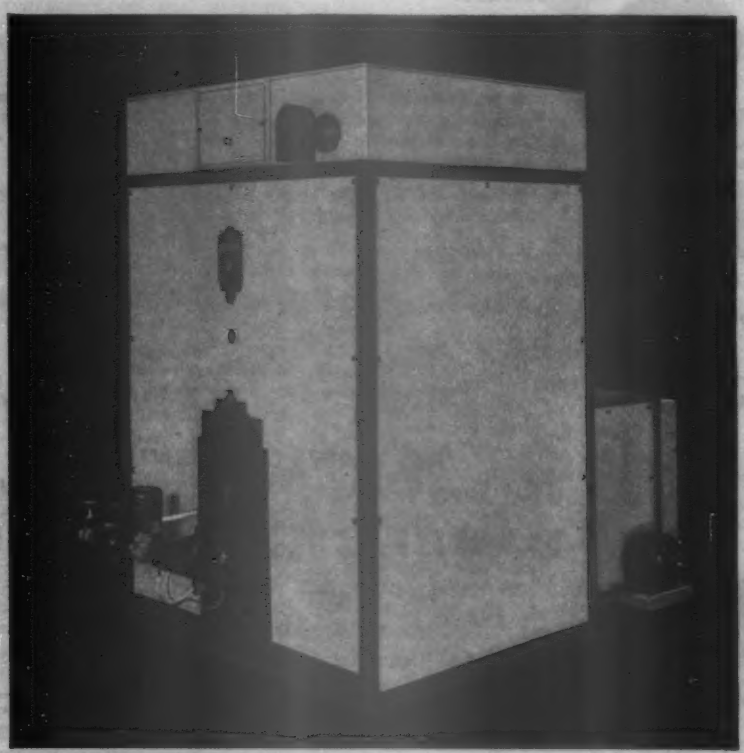
Standard equipment includes burner assembly, Minneapolis-Honeywell electric motor valve and plain thermostat, thermostat wire, dead weight pressure regulator, SC automatic pilot. Rectangular burners having 4 or 5 burner heads are equipped with two automatic pilots.

Surface Combustion gas-fired unit heaters are available in many sizes and types.

There is a correct type and size (or combination of sizes) for any space heating requirement. They are applicable for heating stores, shops, restaurants, theatres, beauty parlors, garages, service stations, filling stations, assembly halls, dance halls, beer parlors, factories, airplane hangars, and in short, all types of buildings, large or small.

C-834 model meets the demand for a heater with a capacity applicable to a wide variety of types of areas to be heated. Its capacity will meet the requirements demanded in the large number of the more usual types of shops, small stores, etc., with medium sized areas to be heated. Hourly input 85,000 B.t.u.

Gas Fired Unit.



S-C Model F Heatmaster.

Leveler for Gas Appliances

Robinson H. Harsh, manufacturer of Resilient Bearings, Washington, D. C., are putting on the market a leg or support Leveler for such equipment as gas ranges and furniture.

The device will adjust the leg or support to any uneven floor surface, and carry any weight the support will. The operation is as follows: When the set-screw is turned to travel inwardly, its cone-shaped head is forced against the ball, and causes the ball to travel downward, thus pushing the plunger downward to the exact distance required to equalize the uneven floor surface; and it is locked in that position, since the ball cannot act to reverse-turn the set-screw.

Temperature Limitation —is *essential* in a *real* EMERGENCY RELIEF VALVE

The KITSON LTP-103 Temperature and Pressure RELIEF VALVE (Lovekin Patent)

Mere pressure relief valves cannot prevent the generation of steam in a domestic water heater. In a closed system, pressure relief is necessary to provide for natural increase in volume of water when heating, but this pressure relief is *not* in itself sufficient to prevent serious trouble, should the water temperature continue to rise.

For absolute safety, it is necessary to *prevent the temperature* of the water reaching a point where (at the pressure within the tank) steam can be generated. Under certain conditions this can happen even with so-called pressure reliefs.

The Kitson temperature controlled valve (Lovekin patent) operates unfailingly when the temperature becomes excessive, no matter what the pressure conditions might be. Of course, this Valve also takes care of the expansion which normally occurs when water is heated.

Send for full particulars.

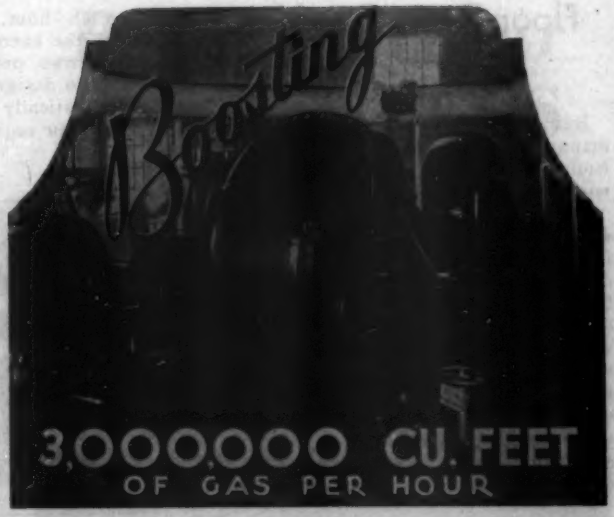
Kitson Company are the sole manufacturers of Emergency Relief Valves under Lovekin patents.

Send for Literature describing our Complete Line of Safety Devices for Domestic Water Heaters

Kitson also manufactures Ground Key Cocks for Gas, Water and Brass Plumbing Products.

KITSON COMPANY
261 No. BROAD ST.
PHILADELPHIA PA.

Established 1897



TWENTY-EIGHT years ago Boston Consolidated Gas Co. selected "R-C" Rotary Positive Gas Pumps as the most efficient and reliable equipment available for maintaining distribution pressures. Operating records prove how wise their choice was.

Two new "R-C" Rotary Positive Gas Pumps of the latest design have now been installed by this company. Similar in essential features of design, but with improvements that still further increase their efficiency, these latest "R-C" Gas Pumps each handle 1,500,000 cu. ft. of gas per hour against a pressure of 7½ lbs.

Experience extending over more than 80 years assures reliability and efficiency in every piece of equipment that carries the Roots-Connersville name plate.

"TOMORROW'S ENGINEERING APPROVED BY YESTERDAY'S EXPERIENCE"

Roots
CONNERSVILLE
BLOWER CORP.
CONNERSVILLE, INDIANA

Floor Type Gas Unit Heater

Buffalo floor type gas unit heaters, manufactured by the Buffalo Forge Co., Buffalo, N. Y., are for use in buildings with large floor area, with high ceilings.

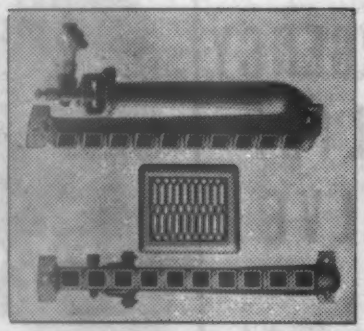
The products of combustion are drawn thru two sets of tubular heating surface by an induced draft fan at one end of the unit. Combustion chamber is alloy metal, end headers and induced draft fan are cast iron. The gas valve is tied in electrically, so that gas shuts off when fan stops—gas shuts off if pilot goes out, and will not go on until pilot is lighted again. Electric gas valve which is furnished as standard equipment is suitable for automatic temperature control from thermostat.

Floor type units can be furnished for side wall or overhead mounting. When mounted overhead, the air flow thru the unit may be reversed delivering the heated air downward at high velocity to reach the cold floor areas.

Guardian Circulator

The No. 6-C Guardian Circulator manufactured by the Guardian Appliances, Inc., Cleveland, O., is the newest item in their line of gas-fired space heaters.

This circulator constantly pulls cold air from the floor and delivers superheated air back into the room. This complete circulation occurs several times each hour. The gas valve is bolted to the burner and therefore cannot be thrown out of alignment. The burner is so designed that the gas pressure automatically regulates the amount of primary air required for perfect combustion.



Specifications of No. 6-C are:

Height 30", width 24½", depth 10"
35 M B.t.u.
Other models are No. 5-C, No. 4-C and No. 3-C

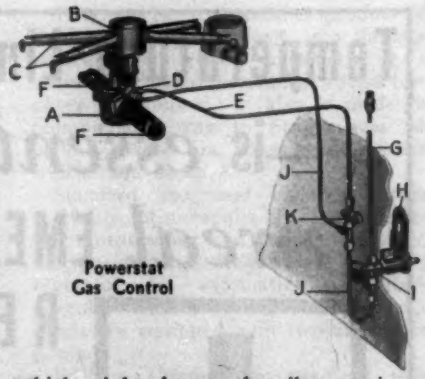
Thermez Gas Boiler

The outstanding features of the Thermez Gas Boilers, as described by the manufacturers, Dunkirk Radiator Corportion, Dunkirk, New York, are as follows:

Staggered fire travel, insuring full utilization of heat produced by the gas flames. Freedom from priming or surging, providing a steady water line at all times. Sections easily cleaned. Burners, air shutters and valves readily removed and replaced. Sound, durable construction with simplicity of design and easy accessibility of all parts. Air used for combustion previously preheated, insuring complete combustion and highest efficiency. Heat radiated from boiler, which is generally lost, used to pre-heat air required for combustion. Air control door automatically closes when gas is off, preventing boiler from cooling rapidly and thus effecting at least a 10% saving in fuel. Air control door easily removed for inspection or adjustment of valves. Standard equipment, readily replaced. Draft diverters removed from top of boiler, saving head room and preventing condensation dripping on top of boiler or controls.

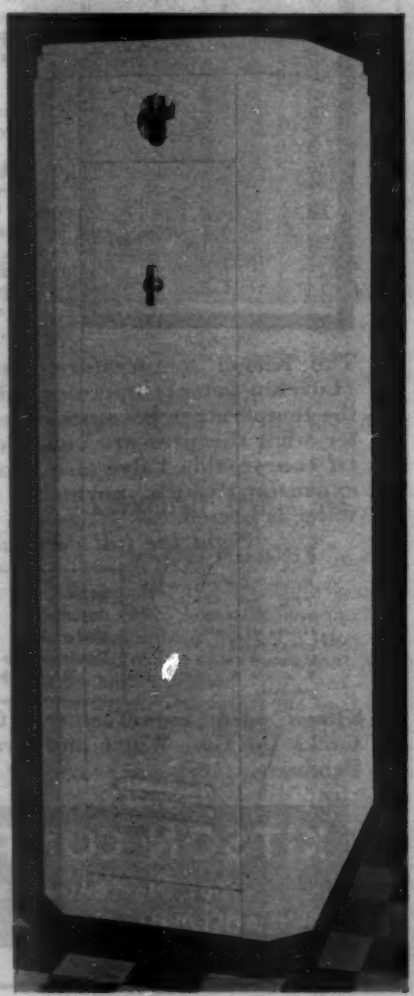
Powerstat Gas Control

Roberts Brass Mfg. Co., Detroit, Mich., make the Powerstat Gas Control. It lights all top burners and oven burner automatically. It has an automatic shutoff valve if pilot lights go out. There is an open push button valve which lights the pilots. This company also makes gas filters which eliminate all gum and other matter which might clog up the pilot opening. These are made of aloxite and carborundum.



Hotstream Cabinet Water Heater

A new water heater being placed on the market is the Hotstream Cabinet Heater, manufactured by the Hotstream Heater Co., Cleveland, O. This water heater has a 20-gallon capacity and the over-all dimensions are 49¾" high, 16½" wide and 22" deep, and carries input ratings of 4,500 B.t.u.; 9,000 B.t.u.; 14,000 B.t.u., and 20,000 B.t.u.



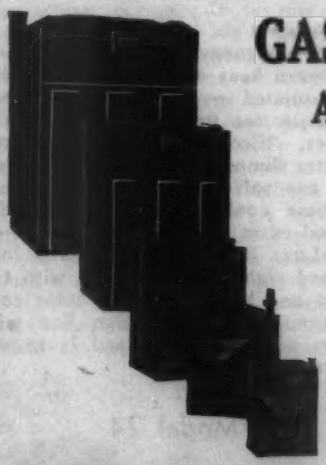
"Using CHACE Exclusively"
LAWSON MANUFACTURING CO
PITTSBURGH, PA.

Should the pilot light of a Lawson water heater become extinguished, a small piece Chace Thermostatic Bimetal becomes responsible for the automatic shutting off of the gas, a highly important duty — Chace Bimetal is unfailing in its service.

Wherever automatic action is desired at change in temperature, or wherever automatic control of temperature is required, use Chace Thermostatic Bimetal, low cost and no upkeep. Sold in sheets, strips or formed to specifications.

CHACE THERMOSTATIC BIMETAL
"It Bends with the Heat"

W. M. CHACE VALVE CO.
1610 Beard Ave. Detroit, Mich.



GAS METERS
ALL SIZES

Diaphragms
Repairs
Provers
Pumps
Calorimeters
Wet Meters
Gauges
Apparatus

METER REPAIR PARTS
FOR
ALL MAKES — ALL SIZES OF METERS
LARGEST GAS COMPANIES NOW
USING OUR PARTS
SEND FOR OUR CIRCULAR ON
METER REPAIR PARTS
SAMPLES AND PRICES
GLADLY SENT

— o —

LAMBERT METER CO.
BUSH TERM. BLDG. 4, BROOKLYN, N. Y.

Build Up Your
COKE SALES
with the

CADET Automatic
COKE BURNER

This fully automatic burner with thermostatic control is a remarkable stimulant to coke sales. It can easily be installed at low cost in any steam, hot water, or warm air plant. What's more, the CADET will burn economically any kind of by-product coke, including breeze.

Undoubtedly many of your present coke users have become interested in automatic heat. Here's a way to protect your coke sales and meet this demand for automatic heat.

Other companies have found our plan attractive. We will be glad to send you complete information.

STO-COKE, Incorporated
2331 N. Illinois St. Indianapolis, Ind.

Send for Complete Details NOW

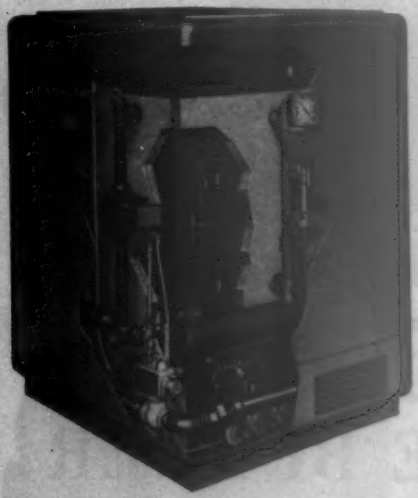
Sto-Coke, Inc.
2331 N. Illinois St.
Indianapolis, Ind.

Gentlemen: Send me full details about the Cadet Automatic Burner at once. I am interested in learning about this new market for the profitable sale of my by-product coke.

Name ..... Position .....
Company .....
Address .....
City ..... State .....

New Developments of American Gas Products Corp.

The Empire Ideal Gas Fired Boiler, manufactured by American Gas Products Corp., New York, was announced several months ago and has many exclusive features.



Empire Ideal Gas Fired Boiler

It includes the same cast iron vertical sections heretofore supplied with Standard Ideal Gas Fired Boilers, but the control arrangement has been simplified and improved, and the entire section assembly has been surmounted with a lustrous gun-metal gray enameled jacket trimmed with chrome fittings. The boiler itself is well insulated and all sheet metal parts which come in contact with the products of combustion are vitreous enameled.

Cast sections are of the patented pin type ground to provide gas tight joints. Steam boilers are provided with a resetting low water cut-off. All boilers are equipped with a thermotor valve which operates from the room thermostat and which embodies thermostatic pilot protection, manual operation, throttling gas flow control and a mechanical upper limit control.

All openings for pipe connections have been placed at the rear. Even the flue openings can be made there.

A.G.P. Gas Conversion Burners

The American Gas Convertor designed for round boilers. The burner itself is coupled to the control system so that a compact installation can be made on any boiler in a very short time.

The front air pouch is connected direct to the front of the boiler and protrudes but 5" from the front of the boiler. The burners are designed with raised ports of small drill size providing high capacity, complete aeration, low turndown possibilities, and freedom from noise. The baffles are self-supporting and are of heavy construction. All controls are centered in a single valve affording thermostatic pilot protection, manual control, throttling control of the gas flow, and a mechanical upper limit control.

The Redflash Convertor is similar in design and was carefully engineered to slip into any existing Series 1 Redflash Boiler. It includes all accessories such as flue passage baffles, flue reducing plate, draft diverter and combustion chamber baffles.

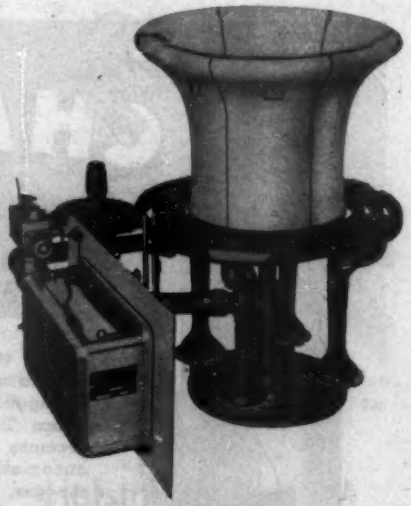
The Dictator Water Heater

The Dictator is a moderately priced heater. It is made with heavy gauge galvanized steel or strengthened copper tank and embodies the center flue construction with patented flue baffle. Base and legs are of cast iron. The tank is heavily insulated with rockwool and is surrounded by heavy gauge jacket beautifully enameled and set off with chrome trimmed escutcheon plate. It utilizes the Titan snap action gas valve in connection with a multi-jet Babber burner with included safety pilot.

This heater is finished in light green baked enamel with a darker green trim. It is also furnished with a gun-metal jacket to match the color and form a companion piece for Empire Gas Boilers.

Storage capacities of 15, 20, 30 and 40 gallons are available. All heaters have high recovery capacities.

A companion product, the A.G.P. Regular utilizes a center flue formed with several kidney shaped flue tubes. It is equipped with a cast iron drilled port burner, and is finished in old ivory, with black trim. It is available in 20, 25, 30, 40 and 75 gallon sizes.



A.G.P. Conversion Burner

Roper Ranges

The following modern gas ranges are manufactured by the Geo. D. Roper Corp., Rockford, Ill.

Deluxe Line

Equipment of the DeLuxe line of Roper gas ranges includes a combination oven heat control and gas valve, an insulated oven, an "Insta-Flame" automatic top lighter, an Astogril side broiler, "EconoSpeed" burners with "Center Simmers," "EconoTrol" rotary disc gas valves, a utility drawer, and Lifetime cooking chart. In addition several extra features are offered.

DeLuxe Ropers are made with four, six and eight burners—some with two ovens and broilers. Three color combinations—Ivory with Sun Tan trim, White with Black trim, and Ivory with Green trim.

Model 24

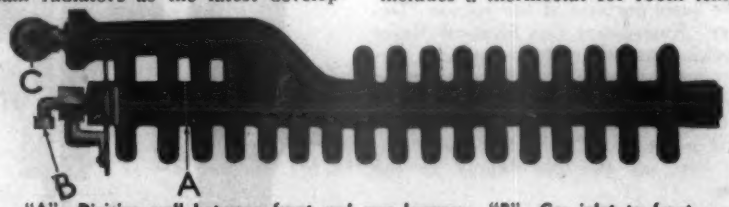
The model 24 Roper is a nominally priced gas range. It has most of the outstanding Roper features, including a combination oven heat control and gas valve, an insulated oven, an "Insta-Flame" automatic top lighter, an Astogril side broiler, four "EconoSpeed" burners with "Center Simmers," two utility drawers, salt and pepper shakers, and a Lifetime cooking chart. The lamp-clock-convenience outlet ensemble and the towel rack pictured are extra equipment.

This range is offered in the same color combinations as the DeLuxe ranges. It may be described as an Advanced Table-Top model.

New Clow Two-Way Burner

James B. Clow & Sons, Chicago, Ill., announce the two-way burner for Gasteam radiators as the latest development in Gasteam Heating Systems. With this burner arrangement, one portion of the burner can be operated separately from the other. The full heat from the radiator can be turned on for quick heating, and then one portion of the burner can be turned off, allowing the remaining portion, which consumes about one-fifth of the gas of the full burner, to carry the load. This feature is important where most of the heat is required early in the mornings and in the evenings during the day. However, this feature can also be used to advantage during the mild portions of severe climates.

The line of Clow Gasteam radiators, includes a thermostat for room temperature control for individual radiators. The thermostat controls the flow of gas to the rear or main burner in accordance with the room temperature, turning on and off the main gas supply when room temperature corresponds to the thermostat setting. The pilot valve controls the gas supply to both the front and rear burner. The remote type of room thermostat allows its being placed against the wall some distance from the radiator.



"A"—Division wall between front and rear burners. "B"—Gas inlet to front burner. "C"—Gas inlet to rear burner.

A Brief History of Lava

The material called "Lava" has proved an excellent material for gas burners, pilots, tips and caps. It is non-carbonizing, non-corrosive and is adaptable to the shapes required.

This rock-like material called "lava" talc, or soapstone, depending upon the grade, is a soft mineral found in the Appalachian region. It is oily and yielding to the touch. As a dielectric, it withstands high potentials with remarkable uniformity for an indefinite period. It is impervious to temperatures of 2000 degrees F. and higher.

Lava is so soft that it can be scraped with the finger nail; hence special tools are not required for machining. For instance, a carpenter's saw is used for cutting it and a wood chisel for working out corners where it is impossible to use a milling cutter. Cutters made up of cold-rolled steel are sufficiently hard to machine lava satisfactorily.

Lava can be drilled and tapped the same as metal, and rods made of this material can be threaded. After machining, the block is asembled or the mechanism is mounted on it to check dimensions and clearances. This procedure is necessary because the lava is hardened by "firing" after machining. After firing, the model is so hard that it cannot be ground with an emery wheel.

In the firing process, the moisture is first driven out by drying in a slow-heating oven with the highest temperature not exceeding 200 degrees F. If the temperature is raised above 212 degrees F. before the material is thoroughly dried, the steam generated will crack the lava. After the drying process, the block is placed in a furnace with a higher temperature rating. The heat is increased slowly until a temperature of at least 1750 degrees F. is reached. The block is then allowed to soak at this temperature, the length of time depending on the size of the block or the thickness of the walls.

Gas Burner Booklet, 31-AG, can be had from American Lava Corporation, Chattanooga, Tenn.

Various Styles of Lava Tips

BESSE, OSBORN & ODELL INC. COLONIAL BRAND BOSTON, U.S.A. RE-CHROME METER LEATHER

"COLONIAL BRAND" RE-CHROME METER LEATHER

Will stand up in the Meter under all variable conditions, heat, cold, or dampness without affecting the diaphragm in any way.

We unqualifiedly recommend its use by all Gas Companies.

OUR OILED BARK METERS

are tanned with hemlock bark before reprocessing into Oil Meters. They are strong and pliable for diaphragms.

We also tan leather for Iron Meters, Governors and Regulators.

BESSE, OSBORN & ODELL, INC.

51 South St., Boston, Mass.

Tanners of "Colonial Brand" Oil and Re-Chrome Meter Leathers

New York Representatives

G. N. BANKART—W. A. SMITH

177 William St., New York City

LAVA

at the Point of Combustion

BURNERS—
PILOTS
TIPS—CAPS

ALCO LAVA BURNERS and *TIPS* are and have been prominent in the development of Gas Burning apparatus.

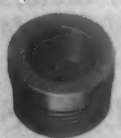
NON-CARBONIZING

NON-CORROSIVE

The material is easily adaptable to the shapes required—and economical in comparison with value received.

Send sketch or sample of designs required — estimates cheerfully supplied.

Ask for special gas burner booklet. 31-AG.



Sole licensees for Barber (Surface) and Clark Industrial Burner Tips.

Also manufacturers of ALSIMAG molded SPECIALTY insulation.

AMERICAN LAVA CORPORATION

Chattanooga, Tennessee

Kitson Valves for Water Heater

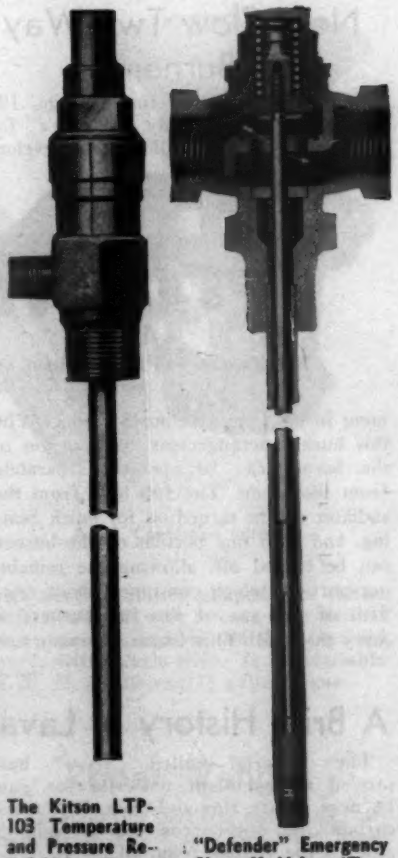
The basic purpose of the Kitson "Defender" Emergency Gas Shut-off Valve (Lovekin patent) is to positively prevent overheating or generation of steam in Gas Water Heater Tanks. Should the temperature of the water reach an unsafe point, the "Defender" automatically cuts off the gas supply to the burner.

An exclusive Kitson feature is that the fuse is not directly exposed to the water, yet it is always in direct thermal contact with the water at the hottest point.

The "Defender" is a real emergency valve because it limits the temperature. It works only when excessive temperature arises; and then having shut off the gas, it stays shut until the trouble can be located and corrected by the Gas Company or Plumber.

The Kitson Temperature and Pressure Relief Valve (Lovekin patent) operates unfailingly when the temperature becomes excessive, no matter what the pressure conditions might be. This Valve also takes care of the expansion which normally occurs when water is heated.

These products are manufactured by the Kitson Company of Philadelphia, Pennsylvania.

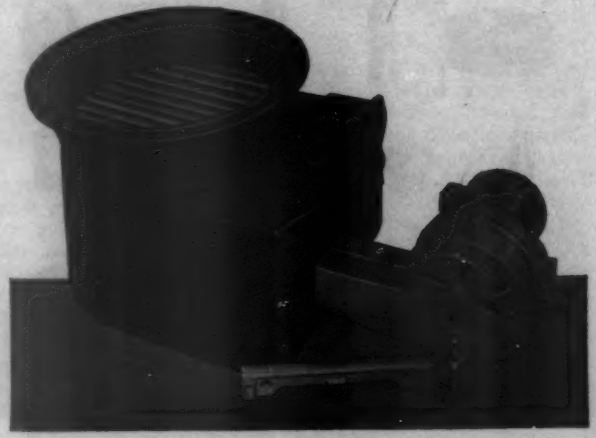


The Kitson LTP-103 Temperature and Pressure Relief Valve (Lovekin patent)

"Defender" Emergency Shut-off Valve (Type IHF-22)

New Burner for Coke Now Being Manufactured

An announcement of great interest to gas companies faced with the problem of selling their by-products coke is that of Sto-Coke, Inc., of Indianapolis, Indiana, who are now manufacturing an automatic, thermostatically controlled burner for coke. This burner, which is known as the Cadet Automatic Burner, has been thoroughly tested and gives clean, automatic heating at a low cost. The Cadet is noiseless and very compact. It has only one moving part and the cost of installing the burner is very low. The Cadet is made in sizes suitable for the smallest home to small apartments and buildings. The manufacturers will be glad to send further information to gas companies desiring complete details.



Cadet Automatic Burner

News of the Gas Industry

The A.G.A. Laboratory Completes a Decade of Service to the Gas Industry

Ten years ago the A. G. A. Testing Laboratory was founded by the American Gas Association to test and certify gas appliances in accordance with nationally accepted standards of construction and performance. Today 25,000 different designs of appliances bear the Laboratory seal of approval and these constitute 90 per cent of the entire number sold in the United States and Canada. An enviable record indeed, but only a small part of what has been accomplished under the able direction of Mr. R. M. Conner.

The Laboratory began operations in June 1925 in space that was made available by the East Ohio Gas Company and with testing equipment a large part of which was donated by manufacturer member companies. By the end of the first year approval requirements for gas ranges and flexible tubing had been formulated and accepted by the Approval Requirements Committee. Before the end of the second year the Laboratory had outgrown its quarters and facilities, so great were the demands made upon it. Land was therefore purchased and there was erected on it the most modern and best equipped gas appliance testing laboratory in the world.

Since 1925 three hundred separate research projects have been completed and reported upon. These have covered every aspect of appliance and accessory design, construction and operating; gas mixing; pipe joints; industrial utilization; the relative merits of different fuels; "gas savers" and domestic utilization.

Out of 26 sets of requirements established by the laboratory for the approval, listing or installation of gas appliances and accessories, 24 have been accepted by the A. S. A. as "American Standard."

Municipal ordinances, building codes and regulations in approximately 50 different places require that gas appliances installed have A. G. A. Laboratory approval or the equivalent of it.

In fact the requirement regulations established by the A. G. A. Laboratory are widely accepted as the most comprehensive, authoritative, equitable and practicable consumer goods standards in existence.

At the meeting of The Institution of Gas Engineers held in London in June of this year, Messrs. Stephen Lacey and C. A. Masterman reported on "National Policies Governing the Testing of Gas Appliances." The situation in Great Britain as well as in eighteen other countries was cited. With respect to the United States the report said in part: "Organized examination and testing of gas appliances has been in existence in the United States of America for a longer period of time than in any other country, and perhaps for that reason is the most complete system in the world at the present time.

R. M. CONNER

"The scheme has received the almost universal support of gas undertakings and appliance manufacturers. Many undertakings have pledged themselves to purchase, and many appliance manufacturers have agreed to market, only those appliances which fulfil the A. G. A. requirements. Since the laboratory's inception, approximately 8,500 appliances have been tested, the results of tests being extended to more than 25,000 separate models by inspection.

"99.8 per cent of all appliances submitted have had to be corrected in some way or other before final aprpoval has been given. The fixing of a standard and the testing of appliances to this standard have resulted in a marked improvement in performance, and while appliances have become more complicated service complaints have been reduced. . . . The improvement is chiefly attributed to the operation of the testing scheme in raising the standard of gas appliances and fittings."

Byllesby Company Sold to Operating Companies

John J. O'Brien, president of Standard Gas and Electric Company, announces that the Company has sold to operating companies in its system, and, without profit to it, the stock of Byllesby Engineering and Management Corporation, all of which has heretofore been owned by Standard Gas and Electric Company. The sale of this stock to the operating companies in the Standard Gas and Electric Company system has been made to carry out the spirit of the recently enacted Federal Public Utility Act of 1935, various state legislation, and the decisions of certain state regulatory commissions. Byllesby Engineering and Management Corporation has for many years rendered management, engineering and other services to these operating companies, which will now be enabled to establish a mutual service company.

Fee On Natural Gas Course Reduced

The enrollment fee for the Home Study Course on Natural Gas conducted by The University of Kansas under the auspices of the National Gas Department of the American Gas Association has been reduced. In announcing the reduction, Harold G. Ingham, Director of the University's Extension Division, stated:

"At the time the course was initiated, we informed representatives of the American Gas Association that it would be necessary for us to make it entirely self-supporting, but that we did not desire to accumulate a surplus above actual cost. The greatly increased enrollments in recent months have enabled us to effect economies in both instructional and administrative costs. Although our expense for the previous six months was much greater, we feel that we are safe in assuming that the volume of enrollments and students' reports will be maintained at the present level. On this basis, we are making a reduction of 10%, which reduces the fee to $54.00 for members of the A. G. A. and employees of member companies. For others, the reduction is proportional, making the fee $72.00, when paid in advance, or $74.50 on the installment plan."

Pacific Coast Gas Association Meeting

The annual meeting of the Pacific Coast Gas Assn. was held at Pasadena, Calif., Sept. 17, 18 and 19. It was well attended and the program contained papers on many subjects of special interest to the industry at this time.

New officers elected were as follows: President, H. M. Crawford, San Francisco; Vice President, Jas. F. Pollard, Seattle; Treasurer, D. G. Martin, San Francisco; Directors: W. J. Bailey, Monrovia; E. H. Coe, Phoenix; H. L. Farrar, San Francisco; E. L. Hall, Portland; A. E. Holloway, San Diego; H. L. Masser, Los Angeles; N. R. McKee, Los Angeles; Wm. Moeller, Jr., Los Angeles; T. E. Roach, Tacoma.

H. M. CRAWFORD

Mr. Crawford, the new President, announced the following appointments:

Chairman, General and Customers Accounting Section, L. E. Green, Los Angeles; Chairman, Sales and Advertising Section, W. M. Jacobs, Los Angeles; Chairman, Manufacturers Section, W. J. Bailey, Monrovia; Chairman, Technical Section, P. E. Beckman, San Francisco; Chairman, Cooperative Advertising Committee, A. C. Joy, San Francisco; Chairman, Educational Committee, E. G. McCann, San Francisco; Chairman, Women's Committee, Alma Freeburg, Santa Cruz.

The following resolution, included in the report of the Resolutions Committee, was adopted:

That the principal problem confronting the gas industry lies in the competitive activities of the producers of other fuels combined with the destructive activities of certain government agencies and politicians through their so-called measuring sticks in various parts of the country has been definitely pointed out by President Moeller in the opening address before this Convention.

The Association, therefore, recommends that immediate, effective and vigorous steps be taken to build up through every possible cooperative effort of its members of all classes, public acceptance for gas as the best and most modern, as well as the most economical fuel for all domestic and many industrial purposes, not only with a load building objective but also to counteract political attacks and destructive propaganda, and that this Association take the necessary steps to bring this matter before the American Gas Association and to urge it to work out and initiate such a campaign on an equally vigorous and nationwide scale.

Pittsburgh Equitable Opens New District Office

The Pittsburgh Equitable Meter Company and its subsidiary, the Merco Nordstrom Valve Company, announce the opening of a new District Office located in the Citizens and Southern Bank Building at Atlanta, Georgia. Mr. G. Wallace Bailey, who has been associated with these companies for many years in managerial capacities, will act as District Manager in charge of this territory, assisted by Mr. M. B. Randle. This office will handle business arising in the states of Georgia and Florida.

Indianapolis Gas Property

After many years of discussion, negotiation and litigation, the Citizens Gas Company was formally transferred September 10 to the city utility district. Immediately city utility officials served notice on the old Indianapolis Gas Company that they do not intend to continue the lease made in 1913, whereby the Citizens company took over the Indianapolis company mains and property to end competition. The lease was for 99 years, and required an annual rental of $600,000. The city offers to continue the status quo of the lease for six months and then will move to confiscate the Indianapolis company mains, if that is necessary. The Indianapolis Gas Company owns roughly 60% of the city's mains, but these are so entwined and joined with Citizens company mains that separation would be impossible. Thomas L. Kemp of Terre Haute was named manager of the new municipal gas company. The city recently sold $8,000,000 bonds to acquire the gas property.

Oil Shales Booklet

Salermo Limited, 14, Waterloo Place, London, England, recently issued a pamphlet describing the Salermo process and the extraction of oil from Oil Shales and Torbanites. The booklet contains some valuable matter on the subject of shale and torbanites and a description of the process.

If any of our readers are interested in this subject, we are advised that the company will be glad to send a copy of their booklet on request.

Manhattan's New Catalog

The Manhattan Rubber Mfg. Division of Raybestos-Manhattan, Inc., Passaic, N. J., announces a new 56-page General Catalog covering their complete line of standard rubber products for industry.

Attractively printed in two colors and bound in a combination cover and file jacket, this new catalog describes their various lines of Belting, Hose, Fittings, Packing, Friction Material, Molded Goods, Sundries and Specialties, Matting and Tread, Rubber Covered Rolls and Tanks, Abrasive Wheels, etc. It also contains list prices and several pages of information tables. Valuable engineering data are included in the material on many of the products, notably belting.

Copies of this new catalog are available direct from the Manhattan Rubber Mfg. Division, Passaic, N. J.

Athens Gas Co. Increases Capacity

Re-design and re-construction of two of the five benches constituting the plant of the Athens Gas Company, Athens, Ga., is being undertaken in order to increase the capacity of the plant and provide for the greatly increased demand for gas now being experienced in Athens, according to Manager C. W. Sweet.

In addition to the three benches now actively in use, two benches have been maintained as spares, to be put in use in case of emergency or temporarily increased demand. One of these active benches is being re-designed and re-built to increase its capacity and alterations and improvements are being made on one of the spares to put it into active service.

Four benches will be operated continuously instead of three, when this work is completed, leaving one to be maintained as an emergency bench.

Atlanta Gas Light Co. Erects Addition to Shop

The Atlanta Gas Light Company, Atlanta, Ga., is constructing an addition, 120 by 160 feet, to its present shop near Moreland Avenue, in order to take care of its increasing business. It will, when completed, cost $25,000, and will provide additional space for the testing laboratory, parts department, and warehouse.

New Chaplin-Fulton Booklet

The Chaplin Fulton Manufacturing Company, Pittsburgh, Pa., have issued Bulletin #2840 describing the Fulton High Pressure Bronze Body Regulator with inlet pressure to 2,000 lbs., outlet pressure 50 to 300 lbs. It is illustrated with cross-sectional views and contains tables of diameters and outlet pressures. Copy may be had on request.

Personals

N. B. Bertolette Elected President Hartford Gas Co.

Norman B. Bertolette has resigned as President of The Harrisburg Gas Company to become President and General Manager of the The Hartford Gas Company, Hartford, Conn. He will be succeeded at Harrisburg by Louis C. Smith, who had been Manager of Fulton County Gas and Electric Company, Gloversville, N. Y., when that company was in the United Gas Improvement Company system.

N. B. Bertolette

Mr. Bertolette was elected President at Harrisburg in April, 1930, after an unusually broad experience in public utility management. Following his graduation in mechanical engineering from Drexel Institute, Philadelphia, in 1911, he held several important managerial positions with the Philadelphia Suburban Gas & Electric Company. When that company, with others, was merged into Philadelphia Electric Company in 1928, Mr. Bertolette assumed an important position with the latter company, which he held until he went to Harrisburg.

Mr. Smith comes back into the U. G. I. System after an absence of 10 years. He was graduated from the University of Pennsylvania in mechanical engineering in 1907, and started with U. G. I. on May 18, 1908, in Philadelphia. He spent three years in distribution and production work here. During his subsequent connections with U. G. I. he had charge of the inventory and appraisal of the distribution system of the Omaha Gas Company in 1911 and 1912, and became engineer and later manager of the Fulton County Company. In 1925, when Mohawk-Hudson system was developed, and U. G. I. sold its interest in Fulton County Company, Mr. Smith became President of the latter company. In 1927, he was elected a Vice-President and Divison Manager of the New York Power and Light Corporation handling operations in the Mohawk and Schenectady Divisions.

On January 1, 1931, Mr. Smith joined the staff of the American Gas Association as Assistant to the Managing Director.

L. C. Smith

Fry is Appointed As Local Manager

Announcement was recently made at the office of the Citizens Gas Company, that Ralph H. Fry, of Hagerstown, Md., had been appointed as local manager for the company, with headquarters in Stroudsburg, Pa. Mr. Fry has been division auditor for the company for a number of years and is very well qualified for the position.

He will succeed H. S. Dutton, Jr., who has been filling the position temporarily for a number of months, following the voluntary retirement of E. E. Bair, because of illness.

Willis S. Yard Leaves Pacific Gas and Electric Company

Willis S. Yard, formerly Vice President in Charge of Gas Construction and Operation, Pacific Gas and Electric Company, San Francisco, Calif., resigned that office on August 1. Mr. Yard is well known throughout the United States as a gas engineer and operating executive. He has held numerous offices in the Pacific Coast Gas Association and was the Association's President in 1927.

R. S. Fuller is now Engineer of Gas Construction and Operation and F. F. Doyle continues as Manager of the Natural Gas Division.

Chas. M. Grow Retires

Chas. M. Grow, New Business Manager of Southern California Gas Company for many years, retired from active service on September 1. Mr. Grow has been prominent in the gas industry for many years and all gas men will wish him a well-earned rest. He has been a member of the Pacific Coast Gas Association since 1911 and served as Chairman of the Commerical Section in 1926 and 1927.

Mr. Grow's retirement will necessitate some changes in the company's sales organization. W. M. Jacobs becomes Assistant General Superintendent of Sales; H. E. Davidson, Sales Promotion Engineer; J. E. Kern, General Supervisor of Domestic Sales; and L. M. Hull, Assistant General Supervisor of Domestic Sales.

New Plant Superintendent

Henry G. Goldschmidt, Jr., has been appointed superintendent of the Peoples Light Co. gas plant, Davenport, Ia.

H. L. Gentry Opens Offices in Jackson, Mich.

Mr. H. L. Gentry, for several years with the Louisville Gas & Electric Company as a geologist and superintendent and later with the Frick-Reid Supply Company as a natural gas and oil engineer, has recently opened offices at 212 Michigan Avenue, W; Jackson, Michigan, as a Consulting Engineer.

Mr. Gentry has specialized in natural gas engineering and valuation work. He has long been a recognized authority on natural gas utility matters and has a wide reputation as a geologist. Recently, Mr. Gentry was summoned to Mount Pleasant, Michigan, to successfully direct the extinguishing of a gas well fire there after every effort had failed and arrangements had been completed to import a large force of specialists from Oklahoma Fields.

Due to the developments in the recently discovered natural gas and oil fields of Michigan, Mr. Gentry has been active in that section.

Irwin Rawson With Stacey Manufacturing Co.

Mr. Irwin Rawson has been elected vice-president in charge of sales of Stacey Manufacturing Co., Cincinnati, Ohio.

Mr. Rawson has been connected with companies serving the Gas Industry for over twenty-five years. Late in 1914 he became associated with the Russell Engineering Company of St. Louis, Missouri, designers, builders and operators of coal gas producing plants.

In 1915 he was placed in charge of Sales to the Gas Industry and in 1923 was appointed Vice-President and General Manager of said Company.

He remained with the Russell Engineering Company in the above capacity until late 1928 when it was merged with the Improved Equipment Company of New York, a subsidiary of the Henry L. Doherty Company.

Mr. P. F. McEnaney will continue as Eastern Sales Manager in charge of the Company's New York office located at 19 West 34th Street.

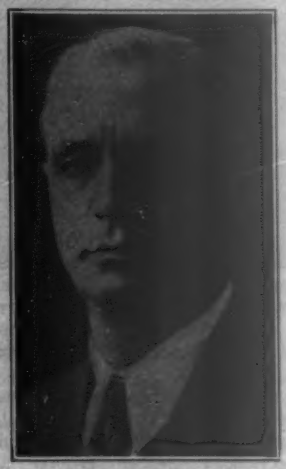
How the Chief Engineer of a Steamship Became a Meter Manufacturer

In a recent issue of the "Bush Terminal Weekly Bulletin," devoted to the activities of the large number of manufacturing firms in their buildings, the following item appeared.

"The year 1870 is a memorable date in world history, especially to Europeans, for it was on July 19th of that year that the Franco-Prussian war began and which ended in the surrender of Napoleon III (Louis Napoleon Bonaparte) to King William of Prussia on September 1st. On September 4th of the same year, France proclaimed a Republic.

"Amid all this world confusion, David N. Lambert, was born. He received his early education in Liverpool, England.

"From the very beginning, young David took a liking to the ships that came to the well known English port and as he played down on the wharfs, he undoubtedly hoped for the day when he might visit the foreign land from whence the ships came.



DAVID N. LAMBERT
President, Lambert Meter Co.

"Mr. Lambert had now reached the age of manhood and when he was twenty-two years old, he realized one of his life's ambitions by receiving his assignment as second mate on a steamship sailing between his home town and Bordeaux, France. His next step forward in the maritime world came two and a half years later, when he obtained a berth as chief engineer on a fishing smack operating along the French coast.

"In 1894, Mr. Lambert came to America where he landed a job as a mechanic with the American Meter Company in whose employ he remained for the next twenty-two years.

"He resigned his position with the American Meter Company when he received an offer to organize the Superior Meter Company, at that time located in Jersey City, N. J. Four years later, in 1921, he organized the well known meter company that bears his name, where he began the manufacture of gas meters, diaphragms, and other gas meter apparatus.

"As an inventor, Mr. Lambert holds patents on dozens of noteworthy medical inventions, some having to do with mechanical resuscitators, automatic anestatomers, and other hospital apparatus, to say nothing of numerous other inventions directly pertinent to his meter business."

R. L. Fisk with Premier Gas Division of Crane Co.

The appointment of Russell L. Fisk as a member of the Premier Gas Division of the Crane Company, has been announced by Stanley Jenks, Eastern Manager. Mr. Fisk has been assigned to the Long Island City, Hempstead and Newark Branches of Crane Company and in this capacity will as field representative cover Manhattan, Long Island, Staten Island and Newark in the sale of Crane gas water heaters, boilers and conversion burners.

Mr. Fisk has had a long experience in the utility and gas water-heating field, following his overseas war service with the Army Engineers. Immediately after leaving the army, Mr. Fisk became a water heater salesman with the Kings County Lighting Company, resigning his post in 1921 to take charge and become metropolitan New York manager of the office of the Lovekin Water Heater Company.

In 1931 Mr. Fisk joined the sales staff of the Brooklyn Union Gas Company and it was as a member of the Water Heater Dealer division that he resigned to join the Premier Gas division of the Crane Company.

Shallcross Controls, Inc., Announce Representatives

Shallcross Controls, Inc., Milwaukee, Wisc., announce the appointment of the following organizations to represent them in the sale of their complete line of automatic controls:

General Instruments & Controls Co., 205 West Wacker Drive, Chicago, Ill. In charge of Mr. Richard Sunderland and Mr. L. C. Wilson. W. O. Taylor & Co., Ltd., Canada Cement Building, Montreal, Canada. Kennedy B. Whitley, 332 West 7th St., Erie, Pa. Walter V. Gearhart Co., Volunteer Building, Atlanta, Ga. Morrissey-Kantenberger Co., Allen Building, Dallas, Texas. P. C. Heckman, 514 Main Street, Cincinnati, Ohio. James F. Strachen, 1014 Oxford St., Berkeley, Calif. J. R. Fortune & Son, 604 Fisher Building, Detroit, Mich.

W. Godbey With Kennedy Valve Co.

The Kennedy Valve Manufacturing Company, Elmira, N. Y., announces the appointment of Mr. William Godbey as its representative in Kansas, Nebraska, Western Missouri, and Southwest Iowa. Mr. Godbey will handle the sales of Kennedy Iron Body and Bronze Valves, Cast Iron Flanged Fittings and Flanges in this territory and his headquarters will be in Kansas City, Missouri.

J. H. Brown With Worthington

Announcement has been received that J. H. Brown, formerly Eastern Sales Manager of Sullivan Machinery Company, has joined Worthington Pump and Machinery Corporation as Regional Manager of its Mining and Construction Division, covering the midwestern territory, with headquarters in Chicago.

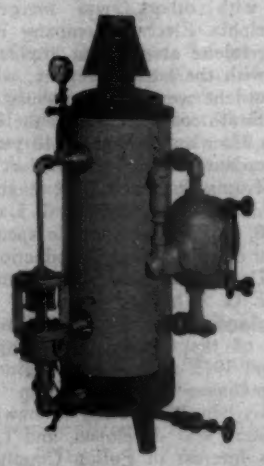
McPherson with Roberts-Gordon

Joseph H. McPherson, of Boston, well-known in the gas appliance field, has been appointed by the Roberts-Gordon Appliance Corporation of Buffalo, N. Y., to represent them in the sale of their conversion burners and industrial unit burners in the New England territory. Mr. McPherson has offices in the Boston Consolidated Gas Building, 250 Stuart Street. The appointment was effective August 1st.

Representatives Appointed

General Refractories Company, Philadelphia, Pa., announce the appointment of The Chas. A. Strelinger Co., Detroit, Michigan, as Dealer Agents in the Detroit area. The Chas. A. Strelinger Co. will carry a complete stock of refractories in addition to their line of industrial supplies.

Pressing Machine and Steam Iron— BOILERS



P. M. LATTNER MFG. COMPANY
CEDAR RAPIDS, IOWA

Obituary

HENRY H. TINKHAM

Henry H. Tinkham, 56, public relations director for Consumers Power Co., Jackson, Mich., since 1921 and former newspaper man of statewide repute, died Thursday, September 12, from a heart ailment after an illness of several months.

Tinkham was legislative correspondent for Booth Newspapers, Inc., for several years before joining Consumers. He became affiliated with the power company after a long career in newspaper work. He started on The Grand Rapids Herald and later was a member of the staffs of the Grand Rapids Post and Grand Rapids Press.

Mr. Tinkham was born in Providence, R. I., and came to Michigan during his boyhood.

ROY E. TUNWALL

Roy E. Tunwall, former Superintendent of the Peoples Light Company Gas Plant, at Davenport, Iowa, died August 30, 1935, at his home, 2510 Davenport Avenue, Davenport, Iowa, after a brief illness. Angina pectoris was the cause of death.

Mr. Tunwall was born on Dec. 22, 1889, in Lynn Center, Illinois. For a number of years, Mr. Tunwall was Superintendent of the Gas Plant of the Peoples Light Company, and was in charge of the change-over from manufactured to natural gas in Davenport. Recently he worked about six months in Iowa City preparatory to the change-over to natural gas.

C. E. WETZEL

Charles E. Wetzel, advertising manager of The United Gas Improvement Company, Philadelphia, died suddenly September 21.

Mr. Wetzel was formerly a member of the Managing Committee of the Publicity and Advertising Section of the Association. He was widely known in public utility advertising circles.

WILLIAM HUTTON BLAUVELT

William Hutton Blauvelt, former general manager of the Semet-Solvay Company and prominent consulting engineer in New York, died September 13 in Pasadena, California. Mr. Blauvelt was a recognized authority in this country and abroad on the production of gas, recovery of by-products from soft coal and the general utilization of fuels.

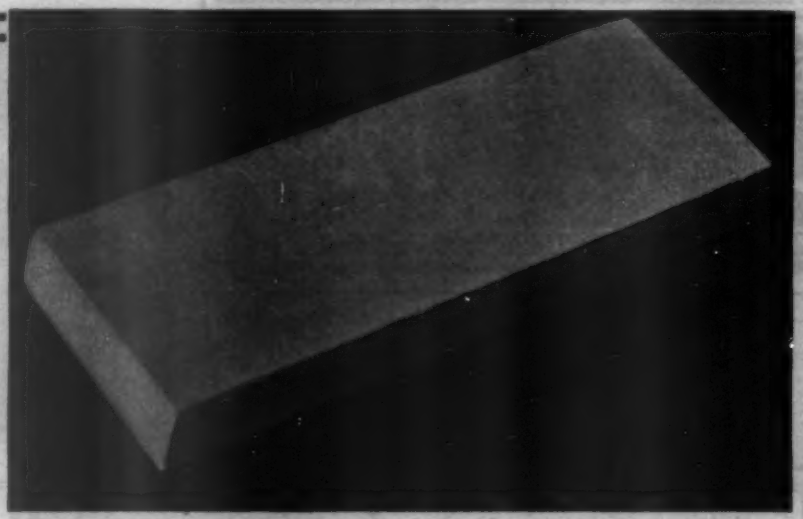
Born March 20, 1863, at Elizabeth, N. J., Mr. Blauvelt was graduated from Lafayette College with degrees of E. M. and M.S. and took a post graduate course in chemistry. He joined the Semet-Solvay Company in 1895, shortly after the company had introduced the Mond Producer and the by-product coke oven in the the United States and his activities centered largely around these new plants. He soon became a recognized authority in the by-product coke oven industry.

While with the Semet-Solvay organization Mr. Blauvelt served as consulting engineer, general manager of operations and later as manager of the new business department. During this period he was very active in the work of the various engineering societies and presented many papers at their annual meetings.

In 1922 Mr. Blauvelt left the Semet-Solvay Company and opened up consulting engineering offices in New York City. As a private consulting engineer his clientele included some of the largest gas companies in the city of Philadelphia.

In 1929 he gave up private engineering practice and joined the Columbia Gas & Electric Corporation as manager of their gas engineering department. This latter position he held until 1932 when failing health compelled him to retire.

GAS RANGE MANUFACTURERS—
Attention Please!



Can you afford to overlook the feature of quality insulation in your new modern gas ranges?

The unique and attractive design plus careful thought and accurate precision of manufacture that is incorporated into your new ranges of today should be carried through in every detail to include insulation.

Ordinary insulation in loosely packed linings will not measure up to the standards required of a permanently insulated range.

THERMINSUL Patented Felted Rock Wool Insulation has been especially designed to meet all the exacting requirements and specifications of a well insulated gas range. This type of insulation gives the most efficient results with longer life and the exclusive features of uniform thickness, non-settling and ease of handling in assembly departments that are found in no other type of insulation.

Your newest and latest models deserve the best insulation if you are to maintain these high standards of perfection throughout your new line.

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HEATING BUNKER "C" OIL

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remain tight and are easily cleaned. These are the requirements for continuous satisfactory operation.

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TOOL AND SUPPLY TRAILERS FOR GAS AND ELECTRIC COMPANIES
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Doubly Sealed—Doubly Tight
Hays Double Seals grip copper pipe in a "double hitch" that makes a joint that will resist great mechanical strains.
Double Seals are copper to copper with no intermediate sealing agent to ever worry about. Double Seals were selected in the piping of "Sleeping Gases" to every operating room in a large western hospital. Use them wherever copper pipe is used, they give plus protection to copper piping.
Write for new 24 page catalog.
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FOR SALE
"Approximately 1000 ft. of 24"—600 ft. of 16" Used Cast Iron Bell & Spigot Pipe, Grade B" Address—The East Ohio Gas Company, 1405 East Sixth Street, Cleveland, Ohio.

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Engineers and Contractors for Complete Gas Works

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Manufacturers of All Kinds of Gas Apparatus

NEWARK, NEW JERSEY

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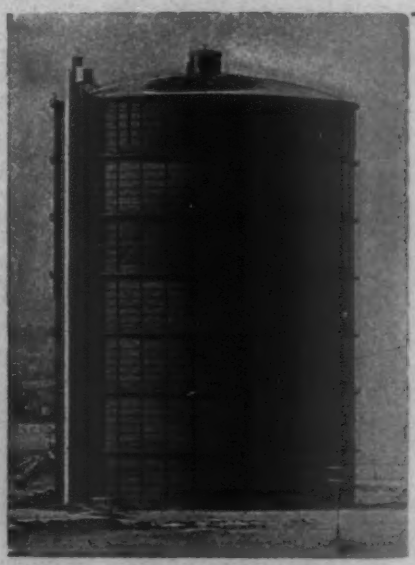

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DO you know the impressive savings in operating and maintenance costs that are possible with this advanced type of dry-seal storage equipment? Before you invest in any other type, let us show you what Stacey-Klonne Holders offer in greater economy and year 'round dependability. We will also gladly quote you on Telescopic Holders, Stacey Bullet High Pressure Holders, Purifiers, Tanks and other plate work. Write to

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GAS CONSTRUCTION COMPANY

STACEY-KLONNE GAS HOLDERS TELESCOPIC HOLDERS— Cincinnati, Ohio "STACEY BULLET" HIGH PRESSURE HOLDERS—PURIFIERS

Indiana Conditional Sales Act

(Continued from page 26)

affixed thereto, shall be filed before such purchase in the office where deeds to realty are filed.

Conditional sales contracts will be valid for three years and may be extended for one year additional periods by filing notice thirty days in advance.

Merchandise may be repossessed only by legal process unless the buyer returns them voluntarily. The seller must give ten days' notice of his intention to repossess. The risk of injury or loss is assumed by the buyer.

If the buyer maliciously secretes or injures the merchandise, he shall be imprisoned not more than one year or fined not more than $500 or both.

The buyer, in case the merchandise has been repossessed, must be given ten days in which to reclaim the goods.

The Orifice Meter

(Continued from page 34)

The factor, $\sqrt{h}\ P_a$, sometimes called the extension, must be computed from the chart record made by the meter. It can be computed by examination and the use of a so-called "extension table" in which the value of the radical is listed under small steps in h and P_a, or it can be computed on a McGaughy integrator; one method, used too infrequently makes use of a square root chart, making it necessary only to multiply together the chart readings of h and P_a to obtain the value $\sqrt{h}\ P_a$.

This rather long and technical discourse may give the impression that to use an orifice meter is a difficult mechanical and mathematical problem. In reality, the work of the committee in publishing Report No. 2, makes it a simple procedure. First, accurate coefficient determination is simplified by comprehensive tables; second, installation dimensions are accurately given; third, meters are now so constructed that it is a simple matter to check the accuracy of differential and static measurement; fourth, chart computation is simplified by the use of square root charts, or integrators. Hence, we have an accurate, reliable, easy measuring device for large volumes and variable pressures.

For the busy man who wants accurate measurement, which is reliable, and trouble free without too many mathematical headaches, the new committee report presents the necessary information on orifice meters in a concise and practical form. For that happy individual who, in addition to workable information, wants to delve into the physics and mathematics of any problem, the report, plus the appendix, forms a good basis for a liberal education in fluid measurement by means of head meters. The mathematics, experimental data, and research work of flow measurement with the orifice meter is one of the most interesting phases of gas measurement; it is an outstanding example of a good practical, useful, and valuable result founded on brilliant and painstaking physics and mathematics.

New Modification of the Circular Manifold, etc.

(Continued from page 29)

tures are used, depending upon the probable composition of the gas analyzed. It is well to keep the air-gas mixture midway between the approximate upper and lower explosive limits of the gases under analysis.

The gases after the explosion are then passed to the first potassium hydroxide pipette, the pump operated, and then the gases returned to the burette and the volume read. The difference between this volume and the volume after explosion gives the percentage of carbon dioxide formed in the explosion.

To find the percentage of methane, multiply the carbon dioxide formed in the explosion by the gas residue after absorbable constituents have been removed, and divide by the sample of gas taken for the explosion.

To find the percentage of hydrogen multiply the carbon dioxide formed in the explosion by two, subtract this from the contraction, take two-thirds of the result, multiply by the gas residue after absorbable constituents, and divide by sample for explosion.

The nitrogen is found by adding all the other constituents together and subtracting from one hundred per cent.

The nitrogen may be checked directly. The gas after absorption of carbon dioxide after the explosion is passed to the pyrogallol pipette and the pump actuated for removal of oxygen present. As the oxygen in this gas is from the air used for the explosion, and as air contains 79.2% nitrogen, .792 times the amount of air taken for the explosion is the nitrogen which should be in the burette after the removal of the oxygen. Therefore the difference between this figure and the actual reading of the burette after the pyrogallol pipette, will be the nitrogen contained in the sample of gas taken for the explosion. The nitrogen in the gas is then calculated by proportion. The value thus found should agree within .5% with the nitrogen found by subtraction from 100.

The following form and calculations illustrate a complete analysis:

Volume taken	100.0
After KOH	98.0
After H_2SO_4	96.6
After Pyrogallol	96.2
After Cuprous chloride	86.5
Air taken for explosion	85.0
Sample for explosion	14.8
Volume before explosion	99.8
Volume after explosion	77.2
Contraction	22.6
After KOH	72.6
CO_2 formed	4.6

2.0%	CO_2
1.4%	Illuminants
0.4%	Oxygen
9.7%	Carbon monoxide
26.9%	Methane
52.0%	Hydrogen
7.6%	Nitrogen
100.0%	Total

$$\frac{86.5 \times 4.6}{14.8} = 26.9\%$$

$$\frac{86.5 \times 2/3\ (22.6 - (2 \times 4.6)}{14.8} = 52.0$$

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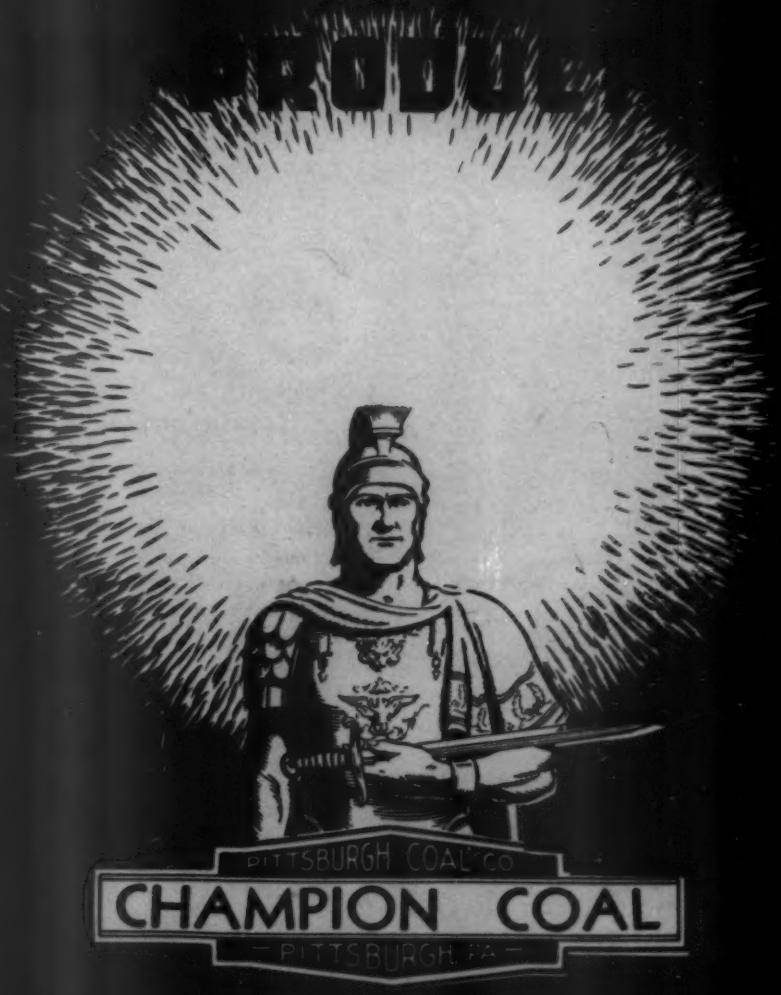
(2) Gas Chemists' Handbook, 3rd Edition, page 286, American Gas Association, N. Y., 1929.

(3) Wilbert J. Huff, An Automatic Gas Pipette, Division of Gas and Fuel Chemistry, American Chemical Society, Washington Meeting, March 29, 1933.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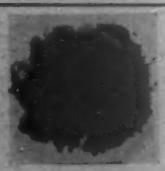
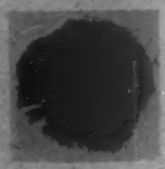
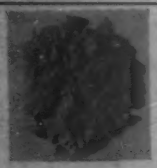
LOWER PURIFICATION COSTS



Sample of CONNELLY FOULED SPONGE that had been in actual service through two foulings in the purifiers. Wt. 5.0 grams.



CONNELLY OXIDE which was in the 5 gram sample. Wt. 1.6 grams, containing 0.56 grams of Fe_2O_3.



Sulphur which 0.56 grams of CONNELLY Fe_2O_3 removed. Wt. 3.283 grams or 65% of the total weight of the sample.

Through uncompromising high quality, long experience and constant research which is maintained for the purpose of perfecting and improving our products, CONNELLY has made certain that gas companies can now purify their gas at the lowest possible cost.

CONNELLY IRON OXIDE and IRON SPONGE are prepared under careful chemical control to standard specifications with the proper physical state of hydration and alkalinity to insure maximum activity and capacity. The use of CONNELLY PATENTED WOOD CHIP FILLER gives our mixed material very important advantages over all others—the chips do not break up into small sizes even when passed through a mechanical oxide conditioner. As a result of this, many operators report an increase of twenty-five per cent in the effective life of the material. In addition, the chips prevent excess packing in the boxes thus providing greater porosity which gives better distribution of gas through the purifying beds and materially reduces back pressure.

Take advantage of our long experience and testing facilities. Let us consult with you regarding your problems of gum removal, alkalinity control and any other problems incident to purification. You will find that we can make many constructive suggestions.

We also manufacture: Connelly Caloroptics; Station Governors; District and Service Regulators; U Gauges; Back Pressure Valves and H_2S Testers.

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